

SOUTH COLUMBIA COUNTY REGIONAL
WASTEWATER TREATMENT PLANT

PREPARED FOR:

COLUMBIA COUNTY BOARD OF COUNTY COMMISSIONERS
P.O. BOX 1529
LAKE CITY, FLORIDA 32056

PREPARED BY:

JIM STIDHAM AND ASSOCIATES, INC.
547 N. MONROE STREET, SUITE 201
TALLAHASSEE, FLORIDA 32301

AND

EUTAW UTILITIES, INC.
415 ST. FRANCIS STREET, UNIT 114
TALLAHASSEE, FLORIDA 32301

JUNE 29, 2009

Jim Stidham and Associates, Inc.
547 N. Monroe Street, Suite 201
Tallahassee, FL 32301

Certificate of Authorization #5629
Chen H. Lin, P.E.
Florida Registration #43340

Date

Eutaw Utilities, Inc.
415 St. Francis St., #114
Tallahassee, FL 32301

Certificate of Authorization #9961
Marc Neihaus, P.E.
Florida Registration #52507

Date

Tomlinson, Peterson, & Associates, Inc.
1958-B Commonwealth Lane
Tallahassee, FL 32303

Certificate of Authorization #3993
John C. Tomlinson, P.E.
Florida Registration #23416

Date

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SECTION 00020

ADVERTISEMENT FOR BID

FOR
SOUTH COLUMBIA COUNTY REGIONAL
WASTEWATER TREATMENT PLANT

Columbia County, Florida is seeking bids from qualified companies to provide the County with a Wastewater Treatment Facility. The work shall include under one Contract the following major items:

- Construction of a .16 million gallon per day (MGD) Sequence Batch Reactor (SBR) and all associated equipment.
- Construction of one equalization tank, one digester and one ground storage tank.
- Construct one chlorine contact chamber and two sludge drying beds.
- Construct one administration building, one chlorine building and one blower building.
- Install two (2) sand filters and various equipment pads.
- Install miscellaneous yard piping and electrical equipment.
- Miscellaneous site work and grading modifications.
- Various blowers, pumps and proprietary filtering and chlorine equipment.
- 175 ekW Generator Set

Alternative Bid Items Include:

I.

- Approximately 3 miles of 6" force main transmission line with a 15 hp duplex lift station.
- De-commissioning and demolition of an existing "package treatment plant".

II.

- Jack and Bore under I-75 for 400' of 24" diameter casing and approximately 2,400' of 6" wastewater transmission line, which terminates in a wet well.

A pre-bid conference will be held on Friday, August 21, 2009 at 10:00 A.M. at 135 NE Hernando Avenue, Lake City, Florida 32056. Any party interested in bidding is encouraged to attend and participate in the conference. Sealed bids, in triplicate will be accepted until 2:00 P.M. on Tuesday, September 8, 2009. Bids will be publicly opened and read aloud at the BOCC

conference room, 135 NE Hernando Avenue, Lake City, Florida 32056. Bids received after 2:00 P.M. on September 8, 2009 will not be opened or considered.

Interested parties should contact Eutaw Utilities, Inc. at 415 Saint Francis Street, Unit #114, Tallahassee, Florida 32301, phone (850) 383-0400 for a complete set of bid documents. A payment in cash or check payable to Eutaw Utilities, Inc. will be required for each complete set of the following Bidding Documents. This payment represents reproduction and shipping costs and is non-refundable. Complete sets of Bidding Documents are \$375.00 for the Drawings and Specifications.

The owner reserves the right to waive any informality or to reject any or all bids. Columbia County is an Equal Opportunity Employer. Each Bidder must deposit with his/her bid security in the amount, form and subject to the conditions provided in the Information for Bidders. Sureties used for obtaining bonds must appear as acceptable according to the Department of Treasury Circular 570 or the by Columbia County Board of County Commissioners.

All projects funded under ARRA must comply with the following additional federal requirements:

(<http://www.dep.state.fl.us/water/wff/cwsrf/cwsrf-arra.htm>)

- Disadvantaged Business Enterprise: [Disadvantaged Business Enterprise](#) requirements must be met for all ARRA projects. The standard DEP supplementary conditions for [construction](#) and [equipment](#) include these requirements and must be incorporated into the bid documents. Also see the [Six Good Faith Efforts](#).
- Davis Bacon wage rate provisions: Additional [supplementary conditions](#) must be incorporated into all bid documents. These conditions require the submission of certified payrolls documenting that the weekly payrolls meet the prevailing wage rate requirements.
- Buy American procurement: Contractors must certify that all manufactured goods meet the Buy American requirements or a waiver must be obtained. We have created a [sample certification form](#) that may be used as a guide.

COLUMBIA COUNTY

BY: Dale Williams, County Manager

Address: Columbia County BOCC
P.O. Box 1529
Lake City, Florida 32056-1529

END OF SECTION

SECTION 00100

INSTRUCTIONS TO BIDDERS

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SECTION 00100
INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

- 1.1 Terms used in these Instructions to Bidders, which are defined in the General Conditions have the meanings assigned to them in the General Conditions, as supplemented. The term "Apparent Low Bidder" means the Bidder submitting the lowest Bid at the Bid opening without correction of numerical discrepancies or determination of responsiveness and responsibility. The term "Successful Bidder" means the Bidder to whom Owner awards or expects to award the Contract. Bidding Documents consist of the Project Manual and Drawings, both as may be modified by Addenda.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

- 2.1 Complete sets of Bidding Documents in the number and for the sum stated in the Advertisement for Bids may be obtained from the Engineer. This amount represents reproduction costs and is non-refundable. Bidder must register as a document holder with the Engineer.
- 2.2 Complete sets of full size Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.3 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

- 3.1 Each Bid must contain Bidder's license number to do business in the State of Florida.
- 3.2 To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit, within seven (7) calendar days after Bid opening, information including, but not limited to, the qualifications submittals set forth in Article 17 of these Instructions to Bidders, evidence of authority to conduct business in the jurisdiction where the Project is located. Submittals requested pursuant to this paragraph shall be referred to as the Qualifications Submittals and are in addition to those required elsewhere.
- 3.3 Bidders will be evaluated with respect to having successfully completed projects of a similar size, nature and time frame.

ARTICLE 4 - EXAMINATION OF CONTRACT DOCUMENTS AND SITE

- 4.1 It is the responsibility of each Bidder before submitting a Bid:
 - 4.1.1 To obtain a set of Bidding Documents and register as a document holder with the Engineer.
 - 4.1.2 To examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical data" referred to below);
 - 4.1.3 To visit the site to become familiar with and satisfy Bidder as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work;
 - 4.1.4 To consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;
 - 4.1.5 To study and carefully correlate Bidder's knowledge and observations with the Contract Documents and such other related data; and
 - 4.1.6 To promptly notify Engineer of all conflicts, errors, ambiguities or discrepancies which Bidder has discovered in or between the Contract Documents and such other related documents.
- 4.2 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Contract Documents due to differing or unanticipated conditions appear in Paragraphs 4.2 and 4.3 of the General Conditions.
- 4.3 Before submitting a Bid each Bidder will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.
- 4.4 On request, Owner will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests and studies as each Bidder deems necessary for submission of a Bid. Bidder must fill all holes and clean up and restore the site to its former conditions upon completion of such explorations, investigations, tests and studies.

- 4.5 Reference is made to the Supplementary Conditions for the identification of the general nature of work that is to be performed at the site by Owner or others (such as utilities and other prime contractors) that relates to the work for which a Bid is to be submitted. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such work.
- 4.6 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) that may be shown or indicated or expressly required by the Contract Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Contract Documents and the written resolutions thereof by Engineer is acceptable to Bidder, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 - ADDENDA AND INTERPRETATIONS

- 5.1 Bidders shall promptly notify Engineer of any ambiguity, inconsistency, or error which they may discover upon examination of the Bidding Documents or the site.
- 5.2 All questions about the meaning or intent of the Bidding Documents shall be submitted to Engineer in writing or via facsimile to (888) 878-2939. Replies considered necessary will be issued through Addenda by certified mail to all parties recorded by Engineer as having received complete sets of Bidding Documents up to seventy-two (72) hours before bid time. Brief addenda may be issued between seventy-two (72) hours and twenty-four (24) hours before bid time by telegram or facsimile to all parties recorded by Engineer as having received complete sets of Bidding Documents only. Questions received less than seven (7) calendar days prior to the date for opening of Bids will not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect and may not be relied upon by Bidders in submitting their bids. Failure of any Bidder to receive any such addendum or interpretation shall not relieve such Bidder from its terms and requirements.

ARTICLE 6 - BID SECURITY

- 6.1 Bid Security will be submitted and shall be made payable to Owner, in an amount of not less than five percent (5%) of the Bidder's Contract Price and in the form of a certified or cashier's check or a Bid Bond issued by a Surety meeting the requirements of Article 5 of the General Conditions as amended by the Supplementary Conditions. The Bid Bond shall be issued by a company having a registered agent in the State of Florida. Personal checks are not acceptable.

- 6.2 The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required payment and performance bonds, whereupon the Bid Security will be returned. If the Successful Bidder fails to furnish the qualifications submittals or fails to execute and deliver the Agreement and furnish the required Bonds within fifteen (15) days of the Notice of Award, Owner may annul the Notice of Award and the Bid Security of that Bidder will be forfeited. The Bid Security of any Bidder whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the ninety-first (91) day after the Bid opening. Bid Security of other Bidders will be returned approximately seven (7) days after the Bid opening.

ARTICLE 7 - CONTRACT TIME

- 7.1 The number of consecutive calendar days within which, or the date by which, the Work is to be completed (the Contract Time) is set forth in Section 00500: Agreement.

ARTICLE 8 - LIQUIDATED DAMAGES AND INDEMNITY

- 8.1 Notwithstanding anything to the contrary contained elsewhere in any of the attached documents, the County will not indemnify or hold harmless any other party to this agreement for and from any acts, actions or claims arising under this agreement.
- 8.2 Provisions for liquidated damages and incentive payments (if any) are set forth in Section 00500: Agreement.
- 8.3 All Bidders must state in the Bid Form the amount of consideration required by the Bidder in return for the Bidder's promise of indemnity contained in Paragraph 6.31 of the General Conditions and 725.06 of Florida Statutes. The amount to be stated shall be no less than \$1,000.

ARTICLE 9 - SUBSTITUTE MATERIAL AND EQUIPMENT

- 9.1 The Contract, if awarded, will be awarded on the basis of material and equipment illustrated and described on the Drawings or specified in the Specifications. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the "effective date of the Agreement" and only for such items identified on the Bid Form at the time of bid. The procedure for submittal of any such application by Contractor and consideration by Engineer is set forth in the General Conditions, as may be supplemented in Division 1, General Requirements. If a substitution list is provided as part of the prescribed Bid Form, Bidders must identify proposed substitute materials and equipment at time of Bid submission. These substitute materials and equipment shall be evaluated after "Effective Date of the Agreement." Only the proposed alternatives, substitutions or "or equal" items listed on the Substitution List will be evaluated by the Engineer in accordance with the General Conditions. The cost

of changes in related work, additional drawings which may be required to illustrate or define the alternate equipment and its relationship to the other parts or portions of the Work shall be paid by the Contractor. No change will be made in the amount of time in which to complete the Work or in the liquidated damages. If the proposed substituted material or equipment is found to be unacceptable to the Engineer as an "or equal" item, then the material or equipment named in the Specifications or the Bid Form (circled item) shall be furnished by the Contractor. If Bidder fails to circle one of the listed manufacturer's then the manufacturer identified as "A" shall be furnished.

ARTICLE 10 - SUBCONTRACTORS, ETC.

- 10.1 The Apparent Low Bidder shall within seven (7) days after the date of the Bid Opening, submit to Owner a list of all Subcontractors and other persons and organizations proposed for the project, including those who are to furnish the principal items of material and equipment as indicated in the principal items of material and equipment as indicated in Questionnaire. This list shall include the name and address of the Subcontractor, person or organization, a description of the services, materials or equipment to be supplied, estimated time required for preparation and submittal of shop drawings, and estimated lead times required for the fabrication of any long lead items and concurrence thereof. Such list shall be accompanied by a statement of experience with pertinent information as to similar projects and other evidence of qualification for each such Subcontractor, person or organization. If Owner or Engineer has a reasonable objection to any proposed Subcontractor, other person or organization, either may, before the Notice or Award, request the Apparent Low Bidder to submit an acceptable substitute without an increase in Bid price. Apparent Low Bidder declines to make any such substitution, the Owner may elect not to award the Contract to such Bidder. A Bidder's declining to make any such substitution will not constitute grounds for sacrificing his Bid Security.
- 10.2 Procedures for approval of other Subcontractors after execution of the Agreement are described in the General and Supplementary Conditions.

ARTICLE 11 - BID FORM

- 11.1 The Bid Form is included in the Contract Documents.
- 11.2 Bid Forms must be completed in triplicate in black ink or by typewriter. The Bid price of each item and the total Bid on the Bid Form must be stated in words and numerals; in case of a conflict, words will take precedence.

- 11.3 Bids by corporations must be executed in the corporate name by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature. If requested, the person signing a Bid for a corporation or partnership must produce evidence satisfactory to the Owner of the person's authority to bind the corporation or partnership. If the Bidder is a corporation, and if the Bid is executed by someone other than the president or vice president of the corporation, attach to the Bid a certified copy of corporate resolutions of the board of directors of the corporation authorizing the person to execute the Bid on behalf of the corporation.
- 11.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.
- 11.5 All names and titles must be typed or printed in black ink below the signature.
- 11.6 The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which shall be filled in on the Bid Form).
- 11.7 The address in which communication regarding the Bid are to be directed must be shown.
- 11.8 The business name of bidder shall be clearly typed, printed or stamped at the top of each page of the Bid Form.

ARTICLE 12 - SUBMISSION OF BIDS

- 12.1 Bids shall be submitted before the time and at the place indicated in the Advertisement for Bids, and shall be submitted in an opaque sealed envelope. The envelope shall be marked on the exterior "BID FOR CONSTRUCTION OF THE COLUMBIA COUNTY WASTEWATER TREATMENT FACILITIES" with the name, address and Florida Contractor's License Number of the Bidder and accompanied by the Bid Security and other required documents. Unless otherwise stated in the invitation for bids, bids shall be submitted in writing and not orally, electronically or by facsimile; and shall be sealed. The receipt of bids will be recorded as to the date and the time of receipt in such manner as to indicate whether they were timely submitted. Bids will be accepted unconditionally without alteration. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "SEALED BID ENVELOPE ENCLOSED" on the face thereof. The Owner will in no way be responsible for delays caused by the United States Postal Service or for delays caused by any other occurrence or delivery service.

12.2 Each Bid must contain one (1) copy of the following documents in completed form:

1. Bid Forms (Bidding Documents, entire Section 00300).
Questionnaire (Section 00301).
2. Subcontractor Listing (Section 00301-A).
3. Bid Bond or security (surety bond or cashier's check). (Section 00410).
4. Power of Attorney (for surety bond only).
5. Corporate authority to execute Bid (any corporate employee other than president or vice-president, Section 00410).
6. Non-collusion Affidavit (Section 00480).
7. Trench Safety Affidavit (Section 00490).

12.3 More than one (1) Bid received for the same work from an individual, firm or partnership, a Corporation or Association under the same or different names will not be considered. Reasonable grounds for believing that any Bidder is interested in more than one (1) Bid for the same work will cause the rejection of all such Bids in which the Bidder is interested. If there are reasonable grounds for believing that collusion exists among the Bidders, the Bids of participants in such collusion will not be considered.

ARTICLE 13 - MODIFICATIONS AND WITHDRAWAL OF BIDS

13.1 Bids may only be withdrawn by the bidder only as follows:

- a. Before bid opening – Bids may be withdrawn by any type of notice given by an authorized representative of the bidder, received by the County representative prior to the time set for bid opening.
- b. After bid opening – Bids may not be withdrawn after the time set for bid opening, unless and to the extent:
 - 1.) The invitation to bid so provides; or
 - 2.) The time set forth in the specifications for award of a contract has expired. If no time is set forth, bids shall expire sixty (60) days after bid opening. The County and the successful bidder may mutually agree to an extension of the expiration as long as the bid terms are not otherwise materially altered; or
 - 3.) The County Commission finds after hearing that the withdrawal was justified due to obvious and substantial error and inability to perform.

Sanctions for improper withdrawal of a bid after the bid opening shall be forfeiture of bid bond, if any; or if none, damages or specific performance of the contract plus costs and attorneys fees.

13.2 Rejection of Bids – The County reserves the right to reject any bids or portions of them, as best serves the interest of the County. By way of example and not limitation, bids may be rejected if:

- a. They are non-responsive.
- b. They are materially higher than expected.
- c. Errors in specifications may have caused confusion.
- d. Sufficient funds are not available.
- e. The item or service is no longer needed.
- f. There is a lack of adequate competition.
- g. The item or service can be provided in-house.
- h. The bidder does not qualify under state or federal law.
- i. The bidder is not in compliance with County ordinances. This requirement may be waived if the County finds that the non-compliance is inadvertent, minor and curable as a condition of the award.
- j. The bidder does not appear to have the expertise, financial capability or other ability to meet the requirements of the contract to be awarded, or is otherwise shown not to be responsible.
- k. The bidder is debarred.

ARTICLE 14 - OPENING OF BIDS

14.1 Bids shall be opened at the time and place indicated in the "Advertisement for Bids".

14.2 Processing after Opening:

- a. After bids are opened and recorded, they shall be reviewed by the appropriate County representative for consistence with the requirements contained in the invitation to bid and the specifications and for consistency with any requirements contained in general law. A recommendation for award of a contract shall be forwarded to Board of County Commissioners for final action.
- b. The County Commission shall make the final award of a contract with reasonable promptness. Written notice shall be provided to the successful bidder.

14.3 Criteria for Determining Award of Contract:

- a. Contracts will normally be awarded to the qualified bidder which submits the lowest responsive bid in terms of price. However, nothing herein shall prohibit consideration of relative quality, overall cost over the life of a commodity, warranties, service, fitness, adaptability for particular purpose, and the benefits of standardization.
- b. No criteria may be used in determining acceptability of the bid that were not set forth in the invitation to bid, the specifications, or this policy. However, minor irregularities in bidding procedures may be waived by the Board of County Commission.
- c. In case of a tie bid, the bid will be awarded in the following order: to a bidder located in Columbia County, then to a bidder located in Florida, then by drawing lots in public.
- d. Nothing herein shall prohibit the County from awarding portions of a contract to more than one bidder, if it is in the County's interest to do so.
- e. Any bidder which is awarded a contract, must be in compliance with all requirements for County licenses and permits prior to commencement of the work, unless waived by The Board of County Commissioners.

ARTICLE 15 - BIDS TO REMAIN OPEN

- 15.1 All Bids shall remain open for delivery by the Owner of the Notice of Award for ninety (90) calendar days after the day of the Bid opening, but Owner may, at its sole discretion, release any Bid and return the Bid Security prior to that date.
- 15.2 Extensions of time when Bids shall remain open beyond the ninety (90) day period may be made only by mutual agreement between Owner, the Apparent Low Bidder, and the surety, if any, for the Apparent Low Bidder.

ARTICLE 16 - AWARD OF CONTRACT

- 16.1 Owner reserves the right to reject any and all Bids, to waive any and all informalities and reserve the right to disregard all nonconforming, non-responsive or conditional Bids. Bids may be considered irregular and subject to rejection if in the opinion of the Owner, they show serious omission, unauthorized alternations of form, unauthorized alternate Bids, incomplete or unbalanced unit prices, or irregularities of any kind. The Owner may reject, as non-responsive, any or all Bids where Bidders fail to acknowledge receipt of addenda as prescribed. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Errors in the multiplication of unit prices by the number of units will be resolved in favor of the correct product.

- 16.2 If the Contract is to be awarded, it will be awarded to the most responsive, responsible, lowest Bidder. Owner selected additive or deductive alternates (if any) will be considered in determining the lowest bidder. The Owner reserves the right to accept any or all additive or deductive alternates.
- 16.3 The Owner in its sole discretion, reserves the right to reject any and all bids and to waive any informality concerning Bids whenever such rejection or waiver is in the best interest of the Owner. The ability of a Bidder to obtain a performance and payment bond shall not be regarded as the sole test of such Bidder's competency or responsibility. Nothing contained herein shall place a duty upon the Owner to reject Bids or award the contract based upon anything other than its sole discretion as described herein.
- 16.4 Owner may consider the qualifications and experience of Bidders and other persons and organizations (including those who are to furnish the principal items of materials or equipment) proposed for those portions of the Work as to which the identity of Subcontractors and other persons and organizations must be submitted as provided in Article 17 of these Instructions to Bidders.
- 16.5 Owner may conduct such investigations and require supplemental information as he deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the Work in accordance with the Contract Documents to the Owner's satisfaction within the prescribed time. Owner reserves the right to reject the Bid of any Bidder who does not pass any such evaluation to Owner's satisfaction.
- 16.6 One (1) Contract for the Work will be awarded, if award is made, to the lowest responsible, responsive Bidder. The Apparent Low Bidder who is awarded the Contract will be required to perform the Work as a Prime Contractor. No assignment of the Contract will be allowed without written permission of the Owner.
- 16.7 The Apparent Low Bidder shall submit, upon request of the Owner, documentation evidencing its capability to perform classes of work contemplated, and the necessary plant and sufficient capital to execute the work properly within the time specified. Operating costs, maintenance considerations, performance data and guarantees of materials and equipment may be considered by the Owner.
- 16.8 If the Contract is to be awarded, the Owner will give the Apparent Low Bidder a Notice of Award within ninety (90) days after the date of the bid opening subject to the conditions in Article 15 of these Instruction to Bidders.

ARTICLE 17 - QUALIFICATIONS SUBMITTALS

- 17.1 It is the intention of the Owner to award this contract to a Bidder competent to perform and complete the Work in a satisfactory manner. Accordingly, Owner will require the Apparent Low Bidder to submit, within seven (7) days after bid opening, information

including, but not limited to, the following, 1) evidence of Bidder's certification and license to perform the Work and services; 2) experience with references; 3) financial statement; 4) Preliminary Progress Schedule; and 5) Preliminary Schedule of Values all as set forth below, to allow Owner to conduct qualifications investigations.

- 17.2 The experience and financial statement shall provide data additional to that information provided in the Bid Form pertaining to Contractor's financial resources, adequacy of plant and equipment, manpower, organization, and prior experience with references and a list of all previous or on-going construction contracts over the last five (5) years. Said information shall be certified by a Certified Public Accountant, and shall be submitted on the Associated General Contractors of America Form "Standard Questionnaires and Financial Statement for Bidders," available from AGC, 1975 "E" Street, NW Washington, DC 20006. The Owner at its discretion may require any or all of the above listed information from any other Bidder.
- 17.3 The Preliminary Progress Schedule shall consist of three (3) copies of a diagram and a narrative in accordance with appropriate formats set forth in Section 01310; Progress Schedules, incorporated by reference herein. Activities in the diagram shall show the order in which the Apparent Low Bidder proposes to perform the Work within the constraints and sequencing conditions set forth in the specifications and shall indicate starting and completion dates for key milestones and work pertaining to each Division of the Specifications within each major structure or geographical area of work. Activities shall further identify significant submittals/approvals, major equipment deliveries, equipment testing, Owner's responsibilities, and those of affected utilities and other similarity involved third parties.
- 17.4 The Preliminary Schedule of Values shall consist of an itemization of the Bid by major structures or areas of Work for each Division of the Contract Documents from Division 0 through 16.
- 17.5 The Apparent Low Bidder and his surety, if any, hereby agree that any delays within Bidder's control in the delivery of these Qualifications Submittals will require a written request by Bidder for an extension of the time during which the Bid shall remain open for the Owner's acceptance. Should Owner agree to such extension, Bidder will be required to comply with this Submittal Requirement within five (5) additional calendar days. At the Owner's option, failure by the Apparent Low Bidder to deliver these Qualifications Submittals within the extended period will void evaluation of the Bid and will constitute proof that the Apparent Bidder has abandoned his Bid; his Bid Security shall be declared forfeited to the Owner as liquidated damages, and the Work shall be awarded to another Bidder.
- 17.6 If upon receipt and evaluation of the submittals the Apparent Low Bidder does not pass the evaluations to Owner's satisfaction, Owner reserves the right to reject the Bid.

ARTICLE 18 - BONDS AND INSURANCE

- 18.1 The General Conditions as amended by the Supplementary Conditions sets forth Owner's requirements as to Bonds and Insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by the required Bonds, Insurance Certificates and Endorsements.

ARTICLE 19 -SIGNING OF AGREEMENT

- 19.1 When Owner gives a Notice of Award to the Apparent Low Bidder, it will be accompanied by at least three (3) unsigned counterparts of the Agreement and all other Contract Documents. Within the three (3) days of receipt thereafter, Apparent Low Bidder shall sign and deliver at least three (3) counterparts of the Agreement to the Owner together with the documents required in Article 18 above. Within three (3) days of receipt of the properly executed and completed submittals, Owner will deliver a fully signed counterpart to Bidder.
- 19.2 Failure by a Successful Bidder, to whom the Contract is awarded, to execute the Agreement or to furnish the required Bonds or insurance certificates and endorsements shall be just cause for the annulment of the award and the forfeiture of the Bid Security.
- 19.3 A Successful Bidder who is awarded the Contract and fails to execute the Agreement or furnish the required Bonds or insurance certificates and endorsements within the period specified in Article 18.1 above, shall be liable to the Owner for all damages resulting therefrom including reasonable engineer's and attorney's fees and costs, and engineer's and attorney's fees and costs on appeal. The Bid Security forfeited shall not be a limitation thereon.

ARTICLE 20 - AVAILABILITY OF LANDS FOR WORK

- 20.1 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, construction equipment or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

ARTICLE 21 - TAXES AND FEES

- 21.1 The Contractor shall pay all applicable sales, consumer, use and other similar taxes required by law. The Contractor is responsible for reviewing the pertinent State statutes involving the sales tax and complying with all requirements.

ARTICLE 23 - ORGANIZATION OF DRAWINGS AND PROJECT MANUAL

23.1 Drawings and Project Manual for the Work are incorporated as follows:

- A. The Project Manual, containing Divisions 0 through 16 has been bound together in a single document.
- B. The Drawings have been bound together in a single document.

ARTICLE 24 - REQUIRED DISCLOSURE

- 24.1 With its Bid submission, Bidder shall disclose all material facts pertaining to any felony conviction or any pending felony charges in the last three (3) years in this State or any other state of the United States against (i) Bidder, (ii) any business entity related to or affiliated with Bidder, or (iii) any present or former executive employee, officer, director, stockholder, partner or owner of Bidder or of any such related or affiliated entity. This disclosure shall not apply to any person or entity which is only a stockholder, which person or entity owns 20 percent (20%) or less of the outstanding share of a Bidder whose stock is publicly owned and traded.
- 24.2 At its sole discretion, the Owner may reject any Bidder it finds to lack, or whose present or former executive employees, officers, directors, stockholders, partners or owners are found by the Owner to lack honesty, integrity, or moral responsibility. The discretion of the Owner may be exercised based on the disclosure required herein, the Owner's own investigation, public records, or any other reliable sources of information. The Owner may also reject any Bidder failing to make the disclosure required herein. By submitting a Bid, Bidder recognizes and accepts that the Owner may reject the Bid based upon the exercise of its sole discretion and Bidder waives any claim it might have for damages or other relief resulting from the rejection of its Bid based on these grounds.

ARTICLE 25 - COMPLIANCE WITH OCCUPATION SAFETY AND HEALTH ACT (O.S.H.A.)

- 25.1 In instances where such is applicable due to the nature of the Work with which this Bid is concerned; all materials, equipment, services, etc., as proposed and offered by Bidders must meet and conform to all O.S.H.A. requirements. The Bidder's signature upon the Bid Form (Section 00300) is considered certification of conformance to such requirements.

ARTICLE 26 - PROTESTS

26.1 Resolution of Bid Disputes:

- a. Any person adversely affected by a proposed decision concerning a bid or award may protest the proposed decision by filing a written notice of protest with the County representative prior to the award of the contract, or by presenting the protest to The Board of County Commissioners prior to the award.

- b. The Board of County Commissioners (BOCC) may refer the matter to a hearing officer for an informal hearing and recommendation to BOCC prior to awarding a contract or may determine the protest on its own. The decision of the BOCC constitutes final action by the County.
- c. If a bid is for a public construction work as defined in State law [F.S. 255.20], protest may be made pursuant to F.S. Chapter 120.

END OF SECTION

NAME OF BIDDER: _____

SECTION 00300

BID FORM

DATE SUBMITTED: _____

PROJECT IDENTIFICATION: South Columbia County Regional
Wastewater Treatment Plant

NAME OF BIDDER: _____

BUSINESS ADDRESS: _____

_____ Telephone Number.: _____

CONTRACTOR'S FLORIDA LICENSE NO.: _____

THIS BID IS SUBMITTED TO: Columbia County
P.O. Box 1529
Lake City, Florida 32056-1529

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for ninety (90) days after the day of Bid opening. Bidder will sign and deliver the required number of counterparts of the Agreement with the Bonds and other documents required by the Bidding Requirements within fifteen days after the date of Owner's Notice of Award.
3. In submitting this Bid, Bidder makes all representations required by the Instructions to Bidders and further warrants and represents that:
 - (a) Bidder has examined and carefully studied the Bidding Documents and the following Addenda receipt of which is hereby acknowledged:

No. _____	Dated _____	No. _____	Dated _____
No. _____	Dated _____	No. _____	Dated _____
No. _____	Dated _____	No. _____	Dated _____
 - (b) Bidder has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work;

NAME OF BIDDER: _____

- (c) Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
 - (d) Bidder has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. Bidder accepts the determinations set forth in paragraph SC-4.2.1 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which Bidder is entitled to rely as provided in paragraph 4.2 of the General Conditions. Bidder acknowledges that such reports and drawings are not Contract Documents and may not be complete for Bidder's purposes. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface and subsurface) at or contiguous to the site or otherwise which may affect cost progress, performance of furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Contract Documents.
 - (e) Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.
 - (f) Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
 - (g) Bidder has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Bidder has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.
 - (h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.
4. Bidder submits the following prices to perform all the work as required by the Drawings and Specifications for the construction of the Columbia County Wastewater Treatment Facility Project:

NAME OF BIDDER: _____

- A. Lump sum price for indemnification as specified in the General Conditions as amended in the Supplementary Conditions:

_____ \$ _____
(In Words) (in Figures)

- B. Construction of the SBR and associated equipment:

_____ \$ _____
(In Words) (in Figures)

- C. Construction of Equalization tank, Digester and Ground Storage Tank:

_____ \$ _____
(In Words) (in Figures)

- D. Construction of Chlorine Contact Chamber and two drying beds:

_____ \$ _____
(In Words) (in Figures)

- E. Construction of Administration Building, Chlorine Building And Blower Building:

_____ \$ _____
(In Words) (in Figures)

Alternative Bid Items Include:

- F. Approximately 3 miles of 6" force main transmission line and a 15 hp duplex lift station; and De-commissioning and demolition of an existing "package treatment plant".

_____ \$ _____
(In Words) (in Figures)

- G. Jack and Bore under I-75 for 400' of 24" diameter casing and approximately 2,400' of 6" wastewater transmission line, which terminates in a wet well.

_____ \$ _____
(In Words) (in Figures)

NAME OF BIDDER: _____

- H. All other Work not included in Items A through G to Construct the South Columbia County Regional Wastewater Treatment Plant:

_____	\$ _____
(In Words)	(in Figures)

Total Base Bid Price for the Contract (Sum of Items A through F):

_____	\$ _____
(In Words)	(in Figures)

All Bid items shall include all materials, equipment, labor, permit fees, taxes, tests, miscellaneous costs of all types, overhead, and profit for the item to be complete, in place, and ready for operation in the manner contemplated by the Contract Documents.

5. The following documents are attached to and made a condition of this Bid:
- (a) Bid Security (surety bond or cashier's check).
 - (b) Power of Attorney (for surety bond only).
 - (c) Questionnaire (Bidding Documents, Section 00301).
 - (d) Subcontractor Listing (Bidding Documents, Section 00301-A).
 - (e) Corporate authority to execute Bid (any corporate employee other than president or vice president, Section 00420).
 - (f) Noncollusion Affidavit (Bidding Documents, Section 00480).
 - (g) Trench Safety Affidavit (Bidding Documents, Section 00490).
6. The terms used in this Bid, which are defined in Article 1 of the General Conditions, shall have the meanings assigned to them in the General Conditions as amended by the Supplementary Conditions.
7. Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement.

The Work shall be performed under a Florida Contractor's License. Contract shall not be awarded unless proof of valid license(s) is provided.

If Bidder is: (ALL SIGNATORIES MUST HAVE THEIR NAME PRINTED OR TYPED BELOW THEIR SIGNATURE)

NAME OF BIDDER: _____

SOLE PROPRIETORSHIP

(Individual's Signature) (SEAL)

(Individual's Name) (SEAL)

Doing Business as: _____

Business Address: _____

Telephone No.: _____

Florida License No.: _____

A PARTNERSHIP

(Partnership Name) (SEAL)

(General Partner's Signature)

(General Partner's Name)

Doing Business as: _____

Business Address: _____

Telephone No.: _____

Florida License No.: _____

NAME OF BIDDER: _____

A CORPORATION

(Corporation Name) (SEAL)

(State of Incorporation)

By _____
(Name of Person Authorized to Sign)

(Title)

(Authorized Signature)

(CORPORATE SEAL)

ATTEST _____
(Secretary)

Doing Business as: _____

Business Address: _____

Telephone No.: _____

Corporation President: _____

Florida License No.: _____

NAME OF BIDDER: _____

A JOINT VENTURE

By _____ (SEAL)
(Name)

(Address)

By _____ (SEAL)
(Name)

(Address)

Doing Business as: _____

Business Address: _____

Telephone No.: _____

Florida License No.: _____

(Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above).

8. List the following in connection with the Surety which is providing the Bid Bond. Surety's Name: Surety's Address:

Surety's Name: _____

Surety's Address: _____

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

NAME OF BIDDER: _____

SCHEDULE OF MANUFACTURERS/SUPPLIERS

The Contract Documents are based upon the equipment or products available from the manufacturers/suppliers denoted as "A," "B," etc. However, the Bidder must indicate in his Bid which Base Bid manufacturer/supplier he intends to use for each item of equipment listed by circling one (1) of the listed manufacturers/suppliers. Should the Bidder fail to circle a named supplier, he hereby agrees to provide the item listed as "A." After receipt of bids, the Bidder may not substitute for any manufacturer or supplier circled.

If the Bidder desires to propose one (1) or more substitution or "or equal" manufacturers/ suppliers, he may write in the name of such substitution or "or equal" in the spaces provided on the pages following the lists, but he must, nevertheless, also circle one of the listed manufacturers/suppliers. All substitutions or "or equal" items must be identified at the time of Bid (see paragraph 6.7 of the General Conditions as amended by the Supplementary Conditions). Substitutions or "or equal" items will **not** be considered when determining the Apparent Lowest Bidder. Substitutions or "or equal" items will **not** be evaluated or considered until after the "Effective Date" of the Agreement. The Bidder shall base his Bid on providing one of the listed manufacturers and shall assume for bidding purposes that all substitutions or "or equal" items will not be accepted.

If the proposed substitution or "or equal" manufacturer/supplier is determined "not equivalent" by the Engineer, the Bidder must use the circled manufacturer/supplier. If the Bidder fails to indicate which listed manufacturer/supplier he intends to use or if a substitution or "or equal" is rejected, he must use the supplier listed as "A." Also, if the Bidder circles more than one listed manufacturer/supplier, he must use the first manufacturer/supplier circled (unless a substitution or "or equal" is approved).

Each proposed substitution or "or equal" will be evaluated in accordance with Paragraph 6.7 of the General Conditions following the Effective Date of the Agreement.

In addition to the reimbursement required under Paragraph 6.7 of the General Conditions, the Contractor shall also reimburse the Owner for any engineering costs directly attributable to the change in manufacturers/suppliers, caused by the acceptance of proposed substitutions or "or equal" items, such as; additional field trips for the Engineer, additional redesign costs, and additional review costs, etc. Other costs directly attributable to the change in manufacturers/suppliers caused by the acceptance of proposed substitutions or "or equal" items such as increased electrical requirements, larger building, modifications to structures, additional pumps, piping or tankage, etc., shall be borne by others and not by the Owner. Bidder further agrees that the use of substitute equipment offered will not affect the completion date.

The Owner may request, and the Bidder shall supply any additional information on proposed substitutes or "or equal" items prior to Notice of Award.

NAME OF BIDDER: _____

SCHEDULE OF BASE BID MANUFACTURERS/SUPPLIERS

Item No.	Equipment Item or Material	Specification Section No.	Base Bid Manufacturer/Supplier
1.	Effluent Submersible Pumps	11305	A. Flygt B. Hydromatic
2.	Horizontal Non-Clog Screw Centrifugal Pumps	11312	A. Wemco-Hidrostal B. Cornell C. Goulds D. Ingersoll-Dresser
3.	Prestressed Circular Concrete Tanks	13205	A. Crom Corporation B. PreCon Corporation
4.	Process and Utilizing Piping, Fittings, Valves, and Accessories	15050	
	(Ductile Iron Pipe and Fittings)		A. American Cast Iron Pipe Co. B. U. S. Pipe Company C. Clow Corporation
	(PVC Pressure Piping)		A. J-M Manufacturing B. CertainTeed
	(Gate Valves)		A. American-Darling Valve Co. B. Kennedy Valve Co. C. Dresser Industries, Inc.
	(Butterfly Valves)		A. Dresser Industries B. Kennedy Valve Manufacturing Co. C. Mueller Company D. DeZurik E. Henry-Pratt Co. F. American-Darling Valve Co.
	(Check Valves)		A. Valmatic B. American-Darling Valve Co. C. Kennedy

NAME OF BIDDER: _____

Item No.	Equipment Item or Material	Specification Section No.	Base Bid Manufacturer/Supplier
	(Plug Valves)		A. DeZurik B. Henry-Pratt
	(Combination Air Release Valves)		A. Valmatic B. APCO
5.	Magnetic Flow Meters	13615	A. Isco

NAME OF BIDDER: _____

SUBSTITUTIONS AND "OR EQUAL"

The undersigned as Bidder agrees that substitutions, or "or equal" items will not be considered until after the "Effective Date of the Agreement" and will be evaluated in accordance with Paragraphs 8.1 and 8.2 of the General Conditions as amended by the Supplementary Conditions. If Bidder intends to propose substitutions or "or equal" items after the "Effective Date of the Agreement," it is agreed that these items will be listed on the Substitution List must be included with the Bid (form provided herein). Only the proposed substitutions or "or equal" items listed on the Substitution List and submitted at the time of Bid will be evaluated by the Engineer in accordance with the General Conditions.

SUBSTITUTION LIST OF MANUFACTURERS/SUPPLIERS

Bidder proposes the following substitutions and "or equal" items of alternate manufacturers/suppliers for the equipment of material categories so identified:

	<u>Equipment Item Material</u>	<u>Drawing No.</u>	<u>Spec. Section</u>	<u>Substitute/"or equal" Manufacturer/Supplier (List One Only)</u>	<u>Proposed Price Deduct</u>
1.	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____
6.	_____	_____	_____	_____	_____
7.	_____	_____	_____	_____	_____
9.	_____	_____	_____	_____	_____
10.	_____	_____	_____	_____	_____

END OF SECTION

SECTION 00301

QUESTIONNAIRE

DATE:_____

PROJECT IDENTIFICATION: **South Columbia County Regional Wastewater Treatment Plant**

NAME OF BIDDER:_____

BUSINESS ADDRESS:_____

_____Telephone No.:_____

CONTRACTOR'S FLORIDA LICENSE NO. _____

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

1. How many years has your organization been in business as a General Contractor?

2. Describe and give the date and owner of the last project that you have completed similar in type, size, and nature as the one proposed?

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

4. Name three (3) municipalities or counties for which you have performed work and to which you refer:

5. Have you personally inspected the site of the proposed Work? Describe any anticipated problems with the site and your proposed solutions?

6. Will you Subcontract any part of this Work? If so, describe which portions:

7. What equipment do you own that is available for the Work?

8. What equipment will you purchase for the Work?

9. What equipment will you rent for the Work?

10. Has your organization or any of its principal officers or general partners ever filed for bankruptcy? If yes, give name, date, court, total amount of liability/indebtedness, and an executive summary of remedies adjudicated or arbitrated.

11. Has your organization ever constructed a secondary or advanced wastewater treatment plant before, either for domestic or industrial wastewater? If yes, give owner's name, year of completion, size of facility in million gallons per day, the total dollar cost of the facility, and the contract dollar amount for which your organization was responsible. Give same information for all such facilities.

12. Has your organization ever been late in completing a contract? If yes, give owner's name, allowed completion date, completion date, description of project, dollar amount of the project for which your organization was responsible, number of days late beyond the initial allowed date with allowed extensions, and liquidated damages paid in total. Give same information for all occurrences.

13. For the last three substantial projects that your organization has constructed, what has been the ratio of change order amount to initial contract award, for all change orders other than those that were alternate additions or deductive alternates as part of the initial bid package and initial contract award. Also, give owner's name, completion date, description of project, initial contract award dollar amount of the project for which your organization was responsible, and the total amount of applicable change orders.

14. Has your organization or any of its principal officers or general partners ever filed suit against other organization(s) or person(s)? If yes, give name(s) of other litigant(s), relationship of other litigant(s) to your organization or person, court, final order/resolution

date(s), total amount of litigated liability/indebtedness/indemnity, and an executive summary of remedies adjudicated or arbitrated. List all such litigation.

15. Has any organization(s) or person(s) ever filed suit against your organization or any of its principal officers or general partners? If yes, give name(s) of other litigant(s), relationship of other litigants to your organization or person, court, final order/resolution date(s), total amount of litigated liability/indebtedness/indemnity, and an executive summary of remedies adjudicated or arbitrated. List all such litigation.

16. Is your organization or any of its principal officers or general partners involved in any litigation presently. If yes, give name(s) of litigants, relationship of other litigants to your organization or person, court, date of filing, total amount of litigated liability/indebtedness/indemnity, and an executive summary of what is being adjudicated or arbitrated. List all such litigation.

17. The following is given as a summary of the Financial Statement of the undersigned: (List Assets and Liabilities and use insert sheet if necessary).

18. State the true and exact, correct, and complete name under which you do business.
Bidder is: _____

END OF SECTION

SECTION 00301A

SUBCONTRACTOR LISTING

List all proposed Subcontractors to be used for this Project.

Firm Name,
Address and
Telephone Number

Trade

Estimated
Dollar
Amount

[illegible]

[illegible]

Use additional sheets if necessary.

END OF SECTION

SECTION 00410

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____ as Principal, and _____ as Surety, are hereby held and firmly bound unto Columbia County, Florida, as Owner in the penal sum of, (five percent (5%) of the Contract Bid) _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, successors and assigns to pay Owner upon default of Bidder the penal sum set forth on the face of this Bond.
Signed, this ____ day of _____, 20__.

The condition of the above obligation is such that whereas the Principal has submitted to Columbia County a certain Bid, attached hereto and hereby made a part hereof, to enter into a contract in writing, for the Columbia County Wastewater Treatment Facility Project

NOW THEREFORE,

1. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract Documents.
2. This obligation shall be null and void if:
 - 2.1 Owner accepts Bidder's bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents and Contract Documents, or
 - 2.2 All bids are rejected by Owner, or
 - 2.3 Owner fails to issue a notice of award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by paragraph 5 hereof).
3. Payment under this Bond will be due and payable upon default of Bidder and within thirty (30) calendar days after receipt of Bidder and Surety of written notice of default from Owner which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

4. Surety waives notice of any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by Owner and Bidder, provided that the time for issuing notice of award including extensions shall not in the aggregate exceed one hundred twenty (120) days from Bid Due without Surety's written consent.
5. No suit or action shall be commenced under this Bond prior to thirty (30) calendar days after the notice of default required in paragraph 3 above is received by Bidder and Surety, and in no case later than one year after Bid Due Date.
6. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the county in which the Project is located.
7. Notice required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the part concerned.
8. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.
9. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of the Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of the Bond that is not in conflict therewith shall continue in full force and effect.
10. The term "bid" as used herein includes a bid, offer or proposal as applicable.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set forth above.

Principal (Print Full Name):

Surety (Print Full Name):

_____(Seal)
Surety's Name and Corporate Seal

By: _____(L.S.)

By: _____
Signature (attach power of attorney)

Title: _____

Title: _____

Attest: _____
Signature and Title

Attest: _____
Signature and Title

IMPORTANT - Surety companies executing bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of Florida. See Article 5 of the General Conditions as amended by Supplementary Conditions.

END OF SECTION

SECTION 00420

CORPORATE RESOLUTION

I, _____, Secretary of _____
_____, a corporation organized and existing under the laws of the
State of _____, hereby certify that at a meeting of the Board of Directors of the
Corporation duly called and held on _____, 20____, at which a quorum
was present and acting throughout, the following resolutions were adopted and are now in full
force and effect:

RESOLVED that the following individuals of this corporation are authorized to execute
on behalf of this corporation a Bid and Agreement to Columbia County for the construction of
South Columbia County Regional Wastewater Treatment Plant.

I further certify that the names of the officers of this corporation and any other persons
authorized to act under this resolution and their official signatures are as follows:

<u>NAME</u>	<u>OFFICE</u>	<u>OFFICIAL SIGNATURE</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

IN WITNESS WHEREOF, I have hereunto subscribed my name as Secretary and affixed
the seal of the corporation this _____ day of _____, 20____.

END OF SECTION

SECTION 00470

**SWORN STATEMENT PURSUANT TO SECTION 287.133(3)(a),
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES**

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

1. This sworn statement is submitted to _____
(print name of the public entity)
- 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: _____.)

2. I understand that a "public entity crime" as defined in Paragraph 287.133(1)(g), **Florida Statutes**, means a violation of any state or federal law by a person with respect to and directly related to the transaction of business with any public entity or with an agency or political subdivision of any other state or of the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or an agency or political subdivision of any other state or of the United States and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.
3. I understand that "convicted" or "conviction" as defined in Paragraph 287.133(1)(b), **Florida Statutes** means a finding of guilt or a conviction of a public entity crime, with or without an adjudication of guilt, in any federal or state trial court of record relating to charges brought by indictment or information after July 1, 1989, as a result of a jury verdict, nonjury trial, or entry of a plea of guilty or nolo contendere.
4. I understand that an "affiliate" as defined in Paragraph 287.133(1)(a), **Florida Statutes**, means:
1. A predecessor or successor of a person convicted of a public entity crime; or
 2. An entity under the control of any natural person who is active in the management of the entity and who has been convicted of a public entity crime. The term "affiliate" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate. The ownership by one person of shares constituting a controlling interest in another person, or a pooling of equipment or income among persons when not for fair market value under an arm's length agreement, shall be a prima facie case that one person controls another person. A person who knowingly enters into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months shall be considered an affiliate.
5. I understand that a "person" as defined in Paragraph 287.133(1)(e), **Florida Statutes**, means any natural person or entity organized under the laws of any state or of the United States with the legal power to enter into a binding contract and which bids or applies to bid on contracts for the provision of goods or services

SECTION 00470

let by a public entity, or which otherwise transacts or applies to transact business with a public entity. The term "person" includes those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in management of an entity.

6. Based on information and belief, the statement which I have marked below is true in relation to the entity submitting this sworn statement. (indicate which statement applies.)

_____ Neither the entity submitting this sworn statement, nor any of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, nor any affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989.

_____ The entity submitting this sworn statement, or one or more of its officers, directors, executives, partners, shareholders, employees, members, or agents who are active in the management of the entity, or an affiliate of the entity has been charged with and convicted of a public entity crime subsequent to July 1, 1989. However, there has been a subsequent proceeding before a Hearing Officer of the State of Florida, Division of Administrative Hearings and the Final Order entered by the Hearing Officer determined that it was not in the public interest to place the entity submitting this sworn statement on the convicted vendor list. (attach a copy of the final order.)

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR THE PUBLIC ENTITY IDENTIFIED IN PARAGRAPH 1 (ONE) ABOVE IS FOR THAT PUBLIC ENTITY ONLY AND, THAT THIS FORM IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT I AM REQUIRED TO INFORM THE PUBLIC ENTITY PRIOR TO ENTERING INTO A CONTRACT IN EXCESS OF THE THRESHOLD AMOUNT PROVIDED IN SECTION 287.017, **FLORIDA STATUTES** FOR CATEGORY TWO OF ANY CHANGE IN THE INFORMATION CONTAINED IN THIS FORM.

(signature)

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

Personally known _____

OR Produced identification _____

(type of identification)

Notary Public - State of _____

My commission expires _____

(printed, typed or stamped commissioned name of notary public.)

SECTION 00480
NONCOLLUSION AFFIDAVIT

STATE OF _____

COUNTY OF _____

_____, being first duly sworn deposes and says that:

1. He/She (it) is the _____,
of _____, the Bidder that has submitted the attached
Bid;
2. He/She is fully informed respecting the preparation and contents of the attached Bid and
of all pertinent circumstances respecting such Bid;
3. Such Bid is genuine and is not a collusive or sham Bid;
4. Neither the said Bidder nor any of its officers, partners, owners, agents, representatives,
employees, or parties in interest, including this affidavit, have in any way, colluded,
conspired, connived or agreed, directly or indirectly, with any other Bidder, firm or
person to submit a collusive or sham Bid in connection with the Contract for which the
attached Bid has been submitted; or to refrain from bidding in connection with such
Contract; or have in any manner, directly or indirectly, sought by agreement or collusion,
or communication, or conference with any Bidder, firm, or person to fix the price or
prices in the attached Bid or of any other Bidder, or to fix any overhead, profit, or cost
elements of the Bid price or the Bid price of any other Bidder, or to secure through any
collusion, conspiracy, connivance, or unlawful agreement any advantage against
(Recipient), or any person interested in the proposed Contract;
5. The price or prices quoted in the attached Bid are fair and proper and are not tainted by
any collusion, conspiracy, connivance, or unlawful agreement on the part of the Bidder or
any other of its agents, representatives, owners, employees or parties in interest,
including this affidavit.

By:_____

Typed or Printed Name:_____

Title:_____

Sworn and subscribed to before me this ____ day of _____, 20____, in the
State of _____, County of _____.

_____ Notary Public

My Commission Expires: _____

END OF SECTION

SECTION 00490

TRENCH SAFETY AFFIDAVIT

Trench excavations on this Project are expected to be in excess of 5 feet deep. The Occupational Safety and Health Administration excavation safety standards, 29 CFR 1926.650 Subpart P trench safety standards will be in effect during the period of construction of the Project.

Bidder acknowledges that included in the Bid Price are costs for complying with the Florida Trench Safety Act (90-096, Laws of FL) effective October 1, 1990, and hereby gives assurance that, if awarded the Contract, the Contractor or Subcontractor performing trench excavation work on the Project will comply with the applicable trench safety standards. The Bidder further identifies the costs as follows:

WASTEWATER TREATMENT PLANT UPGRADES

<u>Trench Safety Item (Description)</u>	<u>Cost</u>
A. _____	_____
B. _____	_____
C. _____	_____
_____	\$ _____
Total Cost in Words	

FAILURE TO COMPLETE THE ABOVE SHALL RESULT IN THE BID BEING DECLARED NON-RESPONSIVE

COMPANY NAME: _____

DATE: _____

BY: _____

END OF SECTION

SECTION 00500

AGREEMENT

THIS AGREEMENT made and entered into this _____ day of _____ 20__, by and between Columbia County, Florida, (hereinafter called the OWNER) and _____ (hereinafter called CONTRACTOR);

WITNESSETH:

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 - SCOPE OF WORK

CONTRACTOR, as an independent CONTRACTOR, and not as an agent of the OWNER, shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

- Construction of a .16 million gallon per day (MGD) Sequence Batch Reactor (SBR) and all associated equipment.
- Construction of one equalization tank, one digester and one ground storage tank.
- Construct one chlorine contact chamber and two sludge drying beds.
- Construct one administration building, one chlorine building and one blower building.
- Install two (2) sand filters and various equipment pads.
- Install miscellaneous yard piping and electrical equipment.
- Miscellaneous site work and grading modifications.
- Various blowers, pumps and proprietary filtering and chlorine equipment.
- 175 ekW Generator Set

Alternative Bid Items Include:

I.

- Approximately 3 miles of 6" force main transmission line with a 15 hp duplex lift station.
- De-commissioning and demolition of an existing "package treatment plant".

II.

- Jack and Bore under I-75 for 400' of 24" diameter casing and approximately 2,400' of 6" wastewater transmission line, which terminates in a wet well.

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

South Columbia County Regional Wastewater Treatment Plant

ARTICLE 2 - ENGINEER

The Project has been designed by Eutaw Utilities, Inc., whose address is 415 Saint Francis Street, Unit #114, Tallahassee, FL 32301, who is hereinafter called ENGINEER, and who will assume all duties and responsibilities and will have the rights and authority assigned to the ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 3 - CONTRACT TIME

- 3.1 The Work shall be completed with a substantial completion date and a final completion date. The Work for substantial completion as described below shall be completed within four hundred (400) days after the date when the Contract Times commence to run. The Work for the final completion as described below shall be fully completed and ready for final payment in accordance with Paragraph 14.13 of the General Conditions within four hundred fifty (450) days after the date when the Contract Times commence to run.

The following items of Work are to be one hundred percent (100%) completed and operational prior to substantial completion:

1. All mainline effluent water piping
2. All mainline wastewater force main and gravity piping
3. All wastewater pump stations
4. All air compressors
5. All pump station instrumentation/controls
6. All NPW piping
7. All flow meters

8. All process units
9. All process equipment
10. All site restoration
11. All air piping
12. All structural, electrical, and architectural work

The following schedule is anticipated:

1. Bid Opening: September 8, 2009
2. Contract Award: September 30, 2009
3. Contract Execution and Notice to Proceed September 30, 2009

- 3.2 Liquidated Damages. OWNER and CONTRACTOR recognize that **TIME IS OF THE ESSENCE** of this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER fifteen hundred dollars (\$1,500.00) for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. This amount represents an estimate of OWNER's damages for loss of use and administrative costs associated with delay. After Substantial Completion, if CONTRACTOR shall neglect, refuse or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER five hundred dollars (\$500.00) for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment. This amount represents an estimate of OWNER's damages for loss of use and administrative and costs associated with delay. However, the contractor shall not be entitled to additional payment for timely or early completion of the project.

ARTICLE 4 - CONTRACT PRICE

- 4.1 OWNER shall pay CONTRACTOR for performance of the Work in accordance with the Contract Documents in current funds at the lump sum or unit prices as presented in the Bid Form, which is incorporated herein and made a part hereof by this reference.

- 4.2 OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the amount below:

Total of all unit prices:

	\$ <u> </u> (figures)
(use words)	

- 4.3 The parties expressly agree that the Contract Price is a fixed stipulated sum, except with regard to those items in the Bid, which are subject to unit prices. As provided in paragraph 11.9 of the General Conditions estimated quantities are not guaranteed and determinations of actual quantities and classification are to be made by ENGINEER as provided in paragraph 9.10 of the General Conditions.

ARTICLE 5- PAYMENT PROCEDURES

- 5.1 CONTRACTOR shall submit Applications for Payment in accordance with the Contract Documents. Applications for Payment will be processed by ENGINEER as provided in the General Conditions.
- 5.2 Progress Payments; Retainage. Payment will be in accordance with the State of Florida Prompt Payment Act.
- 5.3 Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but in each case, less the aggregate of payments previously made and less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.7 of the General Conditions.
- 5.3.1 Ninety percent (90%) of the value of Work completed, with the balance being retainage.
- 5.3.2 Ninety percent (90%), with the balance being retainage of the value of materials and equipment not incorporated in the Work, but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in paragraph 14.2 of the General Conditions.
- 5.3.3 Upon Substantial Completion, the Owner may, at his option, increase total payments to CONTRACTOR to ninety five percent (95%) of the Contract Price, with the balance being retainage, less such amounts as ENGINEER shall determine, or OWNER may withhold, in accordance with paragraph 14.7 of the General Conditions.

- 5.4 Final Payment. Upon final completion of the Work in accordance with Paragraph 14.13 of the General Conditions, as supplemented, OWNER shall pay CONTRACTOR an amount sufficient to increase total payments to one-hundred percent (100%) of the Contract Price. However, not less than two percent (2%) of the Contract Price shall be retained until Contract Closeout is completed as specified in Section 01700 and all Record Drawings, specifications, addenda, modifications and shop drawings, including all manufacturers instructional and parts manuals are delivered to and accepted by the ENGINEER.

ARTICLE 6 - CONTRACTOR'S REPRESENTATIONS

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

- 6.1 CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in Article 7) and the other related data identified in the Bidding Documents including "technical data."
- 6.2 CONTRACTOR has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work.
- 6.3 CONTRACTOR is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- 6.4 CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. CONTRACTOR accepts the determination set forth in paragraph SC-4.2 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 4.2 of the General Conditions. CONTRACTOR acknowledges that such reports and drawings are not Contract Documents and may not be complete for CONTRACTOR's purposes. CONTRACTOR acknowledges that OWNER and ENGINEER do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. CONTRACTOR has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing

of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

- 6.5 CONTRACTOR is aware of the general nature of Work to be performed by OWNER and others at the site that relates to the Work as indicated in the Contract Documents.
- 6.6 CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
- 6.7 CONTRACTOR has given ENGINEER written notice of all conflicts, errors, ambiguities or discrepancies that CONTRACTOR has discovered in the Contract Documents and the written resolution thereof by ENGINEER is acceptable to CONTRACTOR, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 7 - CONTRACT DOCUMENTS

The Contract Documents which comprise the entire Agreement between the OWNER and CONTRACTOR are attached to this Agreement, are made a part hereof and consist of the following:

- 7.1 This Agreement (Section 00500) (pages 1 to10, inclusive).
- 7.2 Exhibits to this Agreement, if any.
- 7.3 Performance Bond, Payment Bond and Certificates of Insurance (Sections 00610, 00620 and 00650, respectively).
- 7.4 Notice of Award and Notice to Proceed (Sections 00841 and 00842, respectively).
- 7.5 General Conditions (Section 00700) as amended by the Supplementary Conditions.
- 7.6 Supplementary Conditions (Section 00800).
- 7.7 FDEP Supplementary Conditions (Construction).

- 7.8 Project Manual bearing the general title: Columbia County Wastewater Treatment Facility Project and consisting of one (1) volume including Divisions 0 through 16.
- 7.9 Drawings consisting of a cover sheet and sheets numbers _____ through _____ inclusive with each sheet bearing the following general title as provided in the Drawing Index.

<u>SHEET . NO.</u>	<u>DWG. NO</u>	<u>DESCRIPTION</u>
	<u>CIVIL</u>	
1	C-1	Title Sheet/Location and Vicinity Map
2	C-2	Existing Conditions
3	C-3	Process Flow Diagram
4	C-4	Overall Site Plan
5	C-5	Detailed Site Plan of WWTP
6	C-6	Detailed Site Plan of Spray Field
7	C-7	Grading and Drainage
8	C-8	Civil Standard Details
	<u>STRUCTURAL</u>	
9	S-1	Structural Overview
10	S-2	Building and Concrete Pad Details
11	S-3	Building and Concrete Pad Details
12	S-4	Prestressed Concrete Digester Tank
13	S-5	Prestressed Concrete Digester Tank
14	S-6	Prestressed Concrete Digester Tank
15	S-7	Prestressed Concrete Digester Tank
16	S-8	SBR, EQ. Tank & Headworks Details
17	S-9	SBR, EQ. Tank & Headworks Details
18	S-10	SBR, EQ. Tank & Headworks Details
19	S-11	SBR, EQ. Tank & Headworks Details
20	S-12	Chlorine Contact Chamber Details
21	S-13	Miscellaneous Concrete Pad and Metal Details
22	S-14	Miscellaneous PADS – Plan and Section
	<u>MECHANICAL</u>	
23	M-1	Mechanical Overview
24	M-2	Yard Piping for WWTP
25	M-3	Yard Piping for Spray Field
26	M-4	Standard Yard Piping Details
27	M-5	Headworks Mechanical Details
28	M-6	SBR Unit Mechanical Details
29	M-7	SBR Mechanical Details
30	M-8	SBR Blower Mechanical Details
31	M-9	Equalization Tank Mechanical Details
32	M-10	Equalization Effluent Transfer Pump Detail
33	M-11	Sand Filter Mechanical Details

<u>SHEET</u> <u>. NO.</u>	<u>DWG. NO</u>	<u>DESCRIPTION</u>
34	M-12	Chlorine Building Mechanical Details
35	M-13	Chlorine System Mechanical Details
36	M-14	Chlorine Tank Mechanical Details
37	M-15	Chlorine Contact Chamber Mechanical Details
38	M-16	Chlorine Contact Chamber Effluent Transfer Pump Mechanical Details
39	M-17	Storage Tank Mechanical Details
40	M-18	Storage Tank Effluent Transfer Pump Mechanical Details
41	M-19	Digester Mechanical Details
42	M-20	Digester Blower Mechanical Details
43	M-21	Sludge Drying Bed Mechanical Details
44	M-22	Sludge Drying Bed Shed Detail
45	M-23	Wet Well Mechanical Details
<u>ELECTRICAL</u>		
46	E-1	Electrical Site Plan
47	E-2	Single Line Diagram & MCC Elevations
48	E-3	Control Scheme

- 7.10 Addenda numbers __ through __, inclusive.
- 7.11 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraphs 3.5 and 3.6 of the General Conditions.
- 7.12 Bid Form (Section 00300) (Pages 1 to 11, inclusive) and all documents attached to and made a condition of the Bid.

There are no Contract Documents other than those listed above in this Article 7. The Contract Documents may only be altered, amended, or repealed in accordance with Article 3 of the General Conditions as modified in the Supplementary Conditions.

ARTICLE 8 - MISCELLANEOUS

- 8.1 OWNER and CONTRACTOR each binds himself, his partners, successors, assigns and legal representatives to the other party hereto, his partners, successors, assigns or legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.
- 8.2 Terms used in this Agreement, which are defined in Article 1 of the General Conditions, shall have the meanings indicated in the General Conditions, as modified in the Supplementary Conditions.

- 8.3 If any section, subsection, sentence, clause, phrase, or portion of this agreement is for any reason held invalid or unconstitutional by any court of competent jurisdiction, such portion shall be deemed a separate, distinct and independent provision and such holdings shall not affect the validity of the remaining portions thereof.

ARTICLE 9 - GOVERNING LAW

This Agreement shall be governed by the laws of the State of Florida. Both parties agree that the courts of the State of Florida shall have jurisdiction of any claim arising in connection with this Agreement. In the event of litigation arising out of this Agreement, the prevailing party shall be entitled to the award of attorney's fees and costs at both the trial and appellate level.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR and ENGINEER. All portions of the Contract Documents have been signed or identified by OWNER and CONTRACTOR or identified by ENGINEER on their behalf.

This Agreement will be effective on _____, 20__

OWNER:
Columbia County

CONTRACTOR:

BY: _____

BY: _____

NAME: _____
(type)

NAME: _____
(type)

TITLE: _____

TITLE: _____

ATTEST: _____

ATTEST: _____

NAME: _____
(type)

NAME: _____
(type)

Address for giving notices:

Address for giving notices:

Columbia County BOCC

P.O. Box 1529

Lake City, Florida 32056-1529

Approved as to form and correctness:

_____, 20____

Florida State Contractor's

License No.: _____

END OF SECTION

Section 00610 - Construction Performance Bond

Section 00620 – Construction Payment Bond

SECTION 00650

CERTIFICATE OF INSURANCE

A. INSURANCE REQUIREMENTS

1. Contractor shall purchase and maintain such comprehensive general liability and other insurance as required by the General Conditions and modified by the Supplementary Conditions.

B. CERTIFICATE OF INSURANCE FORM

1. The Certificate of Insurance submitted to the Owner and Engineer shall be on the Insurance Company's form with a format similar to the popular ACORD Corporation form.
2. The Owner and Engineer shall be shown as the Certificate Holder.
3. The Owner's project name and project number shall be shown on the Certificate.
4. Six (6) Certificates shall be submitted along with the executed Contract Agreement and Performance and Payment Bonds.

END OF SECTION

GENERAL CONDITIONS SECTION 00700

TABLE OF CONTENTS OF GENERAL CONDITIONS

<i>Article Number</i>	<i>Description</i>	<i>Pages</i>
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2.0	Additional Instructions and Detail Drawings	00700-4
3.0	Schedules, Reports and Records	00700-4 – 00700-5
4.0	Drawings and Specifications	00700-5
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11.0	Protection of Work, Property and Persons	00700-8 – 00700-9
12.0	Supervision by Contractor	00700-9
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1.0 DEFINITIONS

Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

1.1 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications, or corrections.

1.2 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

1.3 BIDDER - Any person, firm, or corporation submitting a BID for the WORK.

1.4 BONDS - Bid, Performance, and Payment Bonds and other instruments or surety, furnished by the CONTRACTOR and the CONTRACTOR'S surety in accordance with the CONTRACT DOCUMENTS.

1.5 CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion, or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.6 CONTRACT DOCUMENTS - The contract, including Advertisement for Bids, Information for Bidders, Bid, Bid Bond, Agreement, General Conditions, Supplementary General Conditions, Risk Management Requirements, Payment Bond, Notice of Award, Notice to Proceed, Basis of Payment, Change Order, Drawings, Specifications and Addenda.

1.7 CONTRACT PRICE - The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

1.8 CONTRACT TIME - The number of calendar days stated in the Contract Documents for the completion of the work.

1.9 CONTRACTOR - The other person or entity which is a party to this Agreement or Contract, any subsidiaries or affiliates, officers, employees, volunteers, representatives, agents, contractors and subcontractors.

Contractor shall be an independent contractor with respect to all work performed hereunder and neither Contractor nor those employed by Contractor to perform such work shall be deemed the agents, representatives, employees or servants of the OWNER in the performance of such work or any part thereof.

1.10 City - City itself, its City Commission and Constitutional officers, to the extent of

their interests, offices, employees, volunteers, representatives and agents.

- 1.11 DRAWINGS - The parts of the Contract Documents which show the characteristics and scope of the work to be performed and which have been prepared or approved by the Engineer.
- 1.12 ENGINEER - The person, firm or corporation named as such in the Contract Documents.
- 1.13 FIELD ORDER - A written order effecting a change in the work not involving an adjustment in the Contract price or an extension of the Contract time, issued by the Engineer to the Contractor during construction.
- 1.14 NOTICE OF AWARD - The written notice of the acceptance of the Bid from the OWNER to the successful Bidder.
- 1.15 NOTICE TO PROCEED - Written communication issued by the OWNER to the Contractor authorizing him/her to proceed with the work and establishing the date for commencement of the work.
- 1.16 OWNER – **PROJECT OWNER**
- 1.17 PROJECT - The undertaking to be performed as provided in the Contract Documents.
- 1.18 RESIDENT PROJECT REPRESENTATIVE - The authorized representative of the OWNER who is assigned to the project site or any part thereof.
- 1.19 SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the work shall be fabricated or installed.
- 1.20 SPECIFICATIONS - A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, and workmanship.
- 1.21 SUBCONTRACTOR - An individual, firm, or corporation having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the work at the site.
- 1.22 SUBSTANTIAL COMPLETION - That date certified by the Engineer when the construction of the project is sufficiently completed, in accordance with the Contract Documents, so that the project can be utilized for the purposes for which it is intended.

- 1.23 SUPPLEMENTAL GENERAL CONDITIONS - Modifications to General Conditions required by a State agency for participation in the project and approved by the agency in writing prior to inclusion in the Contract Documents, or such requirements that may be imposed by applicable state laws or additional requirements by the OWNER.
- 1.24 SUPPLIER - Any person or organization who supplies materials or equipment for the work, including that fabricated to a special design, but who does not perform labor at the site.
- 1.25 WORK - All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the project.
- 1.26 WRITTEN NOTICE - Any notice to any part of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at their last given address, or delivered in person to said party or their authorized representative on the work.

2.0 ADDITIONAL INSTRUCTION AND DETAIL DRAWINGS

- 2.1 The Contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary to carry out the work required by the Contract Documents.
- 2.2 The additional drawings and instructions thus supplied will become a part of the Contract Documents. The Contractor shall carry out the work in accordance with the additional detail drawings and instructions.

3.0 SCHEDULES, REPORTS AND RECORDS

- 3.1 The Contractor shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the work to be performed.
- 3.2 At the preconstruction meeting, the Contractor shall submit construction progress schedules showing the order in which the Contractor proposes to carry on the work, including dates at which the various parts of the work will be started, estimated date of completion of each part and, as applicable:

3.2.1 The dates at which special drawings will be required.

3.2.2 Respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The Contractor shall also submit a schedule of payments that the Contractor anticipates will be earned during the course of the work.

4.0 DRAWINGS AND SPECIFICATIONS

4.1 The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the work in accordance with the Contract Documents and all incidental work necessary to complete the project in an acceptable manner, ready for use, occupancy or operation by the OWNER.

4.2 In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on drawings shall govern over general drawings.

4.3 Any discrepancies found between the drawings, specifications and on-site conditions or any inconsistencies or ambiguities in the drawings or specifications discovered by the Contractor, shall be immediately reported in writing to the Engineer, who shall promptly address such inconsistencies or ambiguities in writing. Work done by the Contractor after discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

5.0 SHOP DRAWINGS

5.1 The Contractor shall provide shop drawings as may be necessary for the prosecution of the work as required by the Contract Documents. The Engineer shall review all shop drawings in a timely manner. The Engineer's review of any shop drawing shall not release the Contractor from responsibility for deviations from the Contract Documents. The approval of any shop drawing which substantially deviates from the requirement of the Contract Documents shall be evidenced by a Change Order.

5.2 When submitted for the Engineer's review, shop drawings shall bear the Contractor's certification that he has reviewed, checked and approved the shop drawings and that they are in conformance with the requirements of the Contract Documents.

5.3 Portions of the work requiring a shop drawing or sample submission shall not begin until the shop drawing or submission has been approved by the Engineer. A copy of each approved shop drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

6.0 MATERIALS, SERVICES AND FACILITIES

- 6.1 It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete and deliver the work within the specified time.
- 6.2 Materials and equipment shall be so stored as to ensure the preservation of their quality and fitness for the work. Stored materials and equipment to be incorporated in the work shall be located so as to facilitate prompt inspection.
- 6.3 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used cleaned and conditioned as directed by the manufacturer.
- 6.4 Materials, supplies, and equipment shall be in accordance with samples submitted by the Contract and approved by the Engineer.
- 6.5 Materials, supplies and equipment to be incorporated into the work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

7.0 OBSERVATIONS AND TESTING

- 7.1 All materials and equipment used in the construction of the project shall be subject to adequate observation and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.
- 7.2 The OWNER shall provide at its expense all observation and testing services not required by the Contract Documents.
- 7.3 The Contractor shall provide at the Contractor's expense all testing and observation services required by the Contract Documents.
- 7.4 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction requires any work to specifically be observed, tested, or approved, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of observation, testing or approval.
- 7.5 Observations, tests or approvals by the Engineer or others shall not relieve the contractor from the obligations to perform the work in accordance with the requirements of the Contract Documents.

- 7.6 The OWNER, Engineer and the Engineer's representatives will at all times have access to the work. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls, records or personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the work and also for any observation of testing thereof.
- 7.7 If any work is covered contrary to the written instruction of the Engineer, it must, if requested by the Engineer, be uncovered for the Engineer's observation at no additional cost. The cost of reconstruction shall be the responsibility of the Contractor.
- 7.8 If the Engineer considers it necessary or advisable that covered work be observed or tested by others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, or testing as the Engineer may require, that portion of the work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, if, however, such work is not found to be defective, the Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to such uncovering, exposure, observation, testing and reconstruction and an appropriate Change Order shall be issued.

8.0 SUBSTITUTIONS

- 8.1 Whenever a material, article, or piece of equipment is identified on the drawings or specifications by reference to brand name or catalogue numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function may be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may allow its substitution and use by the Contractor.

If a bidder bases their bid on "or equal" products and if the OWNER and/or the Engineer determine that one or more of the bidder's proposed "or equal" projects fails to meet the specifications, the bidder shall be required to provide products confirming with the specifications at no additional cost to the OWNER.

- 8.2 Substitution requests submitted after the bid date will only be considered if there is a substantial savings to the OWNER or if there is a delivery problem with the

specified equipment. The Contractor shall reimburse the OWNER for all engineering costs associated with the review of substitutions submitted after the bid date.

9.0 PATENTS

- 9.1 The Contractor shall pay all applicable royalties and license fees, and shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design, or product of a particular manufacturer or manufacturers is specified, however, if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, the Contractor shall be responsible for such loss unless the Contractor promptly gives such information to the Engineer.

10.0 SURVEYS, PERMITS, REGULATIONS

- 10.1 The OWNER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the work together with a suitable number of bench marks adjacent to the work as shown in the Contract Documents. From the information provided by the OWNER, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batten boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.
- 10.2 The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, shall be charged with the resulting expense and shall be responsible for any mistake that may be caused by their unnecessary loss or disturbance.
- 10.3 Permits and licenses of a temporary nature necessary for the prosecution of the work shall be secured and paid for by the Contractor unless otherwise stated in the Supplemental General Conditions. These shall include OWNER and/or OWNER building permits, burn permits, debris disposal permits, etc. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, the Contractor shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Article 13, Changes in the Work.

11.0 PROTECTION OF WORK, PROPERTY, AND PERSONS

- 11.1 The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the work and other persons who may be affected thereby, all the work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including, but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 11.2 The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The Contractor will erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection. The Contractor will notify OWNER of adjacent utilities when prosecution of the work may affect them. The Contractor will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone of whose acts any of them be liable.
- 11.3 In emergencies affecting the safety of persons, the work or property at the site or adjacent thereto, the Contractor, without special instructions or authorization from the Engineer or OWNER, shall act to prevent threatened damage, injury or loss. The Contractor will give the Engineer prompt written notice of any significant changes in the work or deviations from the Contract Documents caused thereby.

12.0 SUPERVISION BY CONTRACTOR

- 12.1 The Contractor will supervise and direct the work. He will be solely responsible for the means, methods, techniques, sequences, safety program and procedures of construction. The Contractor will employ and maintain on the work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the work.

13.0 CHANGES IN THE WORK

- 13.1 The OWNER may at any time, as the need arises, order changes within the scope of the work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the work, an equitable adjustment shall be authorized by Change Order.

13.2 All changes affecting the project's construction cost or modifications of the terms or conditions of the contract must be authorized by means of a written contract change order which is mutually agreed to by the OWNER and Contractor. The contract change order will include extra work, work for which quantities have been altered from those shown in the bidding schedule, as well as decreases or increases in the quantities of installed units which are different than those shown in the bidding schedule because of final measurements. All changes must be recorded on a contract change order before they can be included in a partial payment estimate.

13.3 When the Contract sum is in whole or in part based on unit prices, the OWNER reserves the right to increase or decrease a unit price quantity as may be deemed reasonable or necessary in order to complete the work contemplated by this Contract.

13.4 The Engineer, also may at any time, by issuing a Field Order, make changes in the details of the work. The Contractor shall proceed with the performance of any changes in the work so ordered by the Engineer even if the Contractor believes that such Field Order entitles the Contractor to a change in Contract price or time, or both. In such event, the Contractor shall give the Engineer written notice thereof within seven (7) days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract price or time within thirty (30) days.

14.0 CHANGES IN CONTRACT PRICE

14.1 The Contract price may be changed only by a Change Order. The value of any work covered by a Change Order or of any claim for increase or decrease in the Contract price shall be determined by one or more of the following methods in the order of precedence listed below:

- a. Unit prices previously approved.
- b. An agreed lump sum.
- c. For extra work performed by Subcontractors; the net amount of the Subcontractor's charge plus a percentage fee of 10% which fee shall include all charges for supervision, overhead and profit, bonds, taxes and insurance.
- d. For work performed by the Contractor's own forces, a reasonable estimate of the net cost of the work (less all discounts) plus a fee of 18% which fee shall include all charges for supervision, field office, general expenses, overhead and profit. Net cost, to which the percentage fee shall be applied, is understood to include state sales taxes, bonds, and delivery expenses of

materials; cost of labor is to include all union fringe benefits and 33% to cover applicable insurance and payroll taxes.

15.0 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the work are essential conditions of the Contract Documents and the work embraced shall be commenced on a date specified in the Notice to Proceed.

15.2 The Contractor will proceed with the work at such rate of progress to ensure full completion within the Contract time. It is expressly understood and agreed, by and between the Contractor and the OWNER, that the Contract time for the completion of the work described herein is a reasonable time, taking into consideration the prevailing weather conditions in the locality of the work.

15.3 If the Contractor shall fail to complete the work within the Contract time, or extension of time granted by the OWNER, then the Contractor will pay to the OWNER the amount for liquidated damages as specified in the Agreement for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

15.3.1 The date of substantial completion shall be that date that the OWNER can receive beneficial use of the work completed and is further defined in Section 00800-Supplementary Conditions. This date is also the date for figuring any liquidated damages. However, if the final work is not fully completed within 30 days from the date of substantial completion, then the OWNER reserves the right to re-activate the liquidated damage clause and the time will run until all work is fully completed, including any outstanding punch list items.

15.4 The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following and the Contractor has provided proper written notice and documentation of such delay to the Engineer.

15.4.1 To any preference, priority or allocation order duly issued by the OWNER.

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another Contractor in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of Subcontractors occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

16.0 CORRECTION OF WORK

16.1 The Contractor shall promptly remove from the premises all work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract Documents and without expense to the OWNER and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

16.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected work within ten (10) days after receipt of written notice, the OWNER may remove such work and store the materials at the expense of the Contractor.

17.0 SUBSURFACE CONDITIONS

17.1 The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by written notice of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents.

17.2 The OWNER shall promptly investigate the conditions, and if it is found that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless the required written notice has been given; provided that the OWNER may, if the OWNER determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

18.0 SUSPENSION OF WORK, TERMINATION, AND DELAY

18.1 The OWNER may suspend the work or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the Contractor, by written notice to the Contractor and the Engineer which shall fix the date on which work shall be resumed. The Contractor will resume that work on the date so fixed. The

Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to any suspension with proper documentation and justification.

- 18.2 If the Contractor is adjudged as bankrupt or insolvent, or makes a general assignment for the benefit of its creditors, or if a trustee or receiver is appointed for the Contractor or for any of its property, or if Contractor files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or repeatedly fails to make prompt payments to Subcontractors for labor, materials or equipment or disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the work or disregards the authority of the Engineer, or otherwise violates any provision of the Contract Documents, then the OWNER may, without prejudice to any other right or remedy and after giving the Contractor and its surety a minimum of ten (10) days from delivery of a written notice, terminate the services of the Contractor and take possession of the project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the work by whatever method the OWNER may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price exceeds the direct and indirect costs of completing the project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the Engineer and incorporated in a Change Order.
- 18.3 Where the Contractor's services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the Contractor will not release the Contractor from compliance with the Contract Documents.
- 18.4 After ten (10) days from delivery of a written notice to the Contractor and the Engineer, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the project and terminate the Contract. In such case, the Contractor shall be paid for all work executed and any expense sustained plus reasonable profit for the work completed.
- 18.5 If, through no act or fault of the Contractor, the work is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the Contractor substantially the sum approved by the Engineer or awarded by arbitrators within forty five (45) days of its approval and presentation, then the Contractor may after ten (10) days from delivery of a written notice to the OWNER and the Engineer

terminate the Contract and recover from the OWNER payment for all work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if the OWNER has failed to make any payment as aforesaid, the Contractor may upon ten (10) days written notice to the OWNER and the Engineer stop the work until paid all amounts then due, in which event and upon resumption of the work change orders, shall be issued for adjusting the Contract price or extending the Contract time or both to compensate for the costs and delays attributable to the stoppage of the work. The Contractor shall properly substantiate any additional costs associated with a work stoppage.

- 18.6 If the performance of all or any portion of the work is suspended, delayed, or interrupted as a result of a failure of the OWNER or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract price or an extension of the Contract time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of the OWNER and Engineer.

19.0 PAYMENT TO CONTRACTOR

- 19.1 On or about the 25th of each month, the Contractor shall submit to the Engineer a partial payment estimate filled out and signed by the Contractor covering the work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the work but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER's title to the material and equipment and protect the OWNER's interest therein, including applicable insurance. The Engineer will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing, approval of payment and present the partial payment estimate to the OWNER, or return the partial payment estimate to the Contractor indicating in writing the reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within forty-five (45) days of presentation of an approved partial payment estimate, pay the Contractor a progress payment on the basis of the approved partial payment estimate less the retainage. The retainage shall be an amount equal to 10% of said estimate. Upon substantial completion of the work, the retainage will be reduced to 2% if requested by the Contractor. The OWNER may, at its sole discretion, reduce the retainage to 2% of specific items of work substantially completed and in full use and operation.
- 19.2 The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

- 19.3 Prior to substantial completion, the OWNER, with the approval of the Engineer and with the concurrence of the Contractor, may use any completed or substantially completed portions of the work. Such use shall not constitute an acceptance of such portions of the work.
- 19.4 The OWNER shall have the right to enter the premises for the purposes of doing work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the work, or the restoration of any damaged work except such as may be caused by agents or employees of the OWNER.
- 19.5 Upon completion and acceptance of the work, the Engineer shall issue a certificate attached to the final payment request that the work has been accepted under the conditions of the Contract Documents. The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be paid to the Contractor within forty-five (45) days of completion and acceptance of the work.
- 19.6 The Contractor will indemnify and save the OWNER, Engineer and the OWNER's agents harmless from all claims growing out of the lawful demand of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools and all supplies, incurred in the furtherance of the performance of the work. The Contractor shall, at the OWNER's request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the Contractor fails to do so, the OWNER may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the Contractor, the Contractor's Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by the OWNER shall be considered as a payment made under the Contract Documents by the OWNER to the Contractor and the OWNER shall not be liable to the Contractor for any such payments made in good faith.
- 19.7 If the OWNER fails to make payment forty-five (45) days after approval by the Engineer, in addition to other remedies available to the Contractor, there shall be added to each such payment interest at the maximum legal rate commencing on the first day after said payment is due and continuing until the payment is received by the Contractor.
- 19.8 No error or oversight in the making of estimates or certificates shall relieve the

Contractor from his obligation to do and complete the work according to the true intent of the specifications and drawings.

19.9 In case labor or materials not in strict accordance with the drawings and specifications are furnished, no certificates will be issued until the defective work has been removed and replaced to the satisfaction of the Engineer.

19.10 In case the Contractor shall fail to complete his Contract or before the time stated in the Contract, no further estimates or payments shall be made until the entire completion of the Contract.

20.0 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the Contractor of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this work. Any payment, however, final or otherwise shall not release the Contractor or its sureties from any obligations under the Contract Documents or the Performance and Payment Bonds.

21.0 INSURANCE

21.1 The Contractor shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of, or result from the Contractor's execution of the work, whether such execution by the Contractor, any Subcontractor, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 The Contractor shall provide the insurance specified in Section 00201, Insurance Requirements, except for coverage's specifically waived by the OWNER, on policies with insurers acceptable to the OWNER.

21.1.2 The insurance requirements shall not limit the liability of the Contractor. The OWNER does not represent that these types or amounts of insurance are sufficient or adequate to protect the Contractor's interests or liabilities, but are merely minimum.

21.1.3 Except for worker's compensation and professional liability, the Contractor's insurance policies shall be endorsed to name the OWNER as an additional insured to the extent of the OWNER's interests arising from this contract or agreement. Contractor shall request its insurers to expand coverage as required herein and to provide that failure of Contractor to comply with any of the policy provisions will not void coverage for the OWNER.

- 21.1.4 Except for worker's compensation, the Contractor waives its right of recovery against the OWNER, to the extent permitted by its insurance policies.
- 21.1.5 The Contractor shall request that its insurer's policies include or be endorsed to include a severability of interests/cross liability provision so the OWNER will be treated as if a separate policy were in existence without increasing the policy limits of liability.
- 21.1.6 The Contractor is responsible for the amount of any deductibles/self-insured retention's, which shall be disclosed to the OWNER and may be disapproved by the OWNER. They shall be reduced or eliminated at the option of the OWNER.

22.0 CONTRACT SECURITY

- 22.1 The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish the OWNER with a Performance Bond and a Payment Bond in penal sums equal to 100% of the amount of the Contract price, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the State of Florida and named on the current lists of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570 and approved by the OWNER. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared as bankrupt or loses its rights to do business in the state in which the work is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, Contractor shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such Bond shall be paid by the Contractor. No further payment shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable Bond to the OWNER.

23.0 ASSIGNMENTS

- 23.1 Neither the Contractor nor the OWNER shall sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, or any obligations thereunder, without written consent of the other party.

24.0 INDEMNIFICATION (HOLD HARMLESS)

- 24.1 The Contractor will indemnify and hold harmless the OWNER and the Engineer and their agents and employees from and against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the work, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom, and is caused in whole or in part by any negligent or willful act or omission of the Contractor, and Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.
- 24.2 In any and all claims against the OWNER or the Engineer, or any of their agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under Workmen's Compensation acts, disability benefit acts or other employee benefits acts.
- 24.3 The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, its agents or employees arising out of the preparation of approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications.
- 24.4 The Contractor agrees to pay, on behalf of the OWNER, and to pay the cost of the OWNER's legal defense, as may be selected by the OWNER; for all claims described in the Indemnification paragraph. Such payment on behalf of the OWNER shall be in addition to any and all other legal remedies available to the OWNER and shall not be considered to be the OWNER's exclusive remedy.

25.0 SEPARATE CONTRACTS

- 25.1 The OWNER reserves the right to let other contracts in connection with this project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate the work with theirs. If the proper execution or results of any part of the Contractor's work depends upon the work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results.
- 25.2 The OWNER may perform additional work related to the project or the OWNER may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (or the OWNER, if the OWNER is performing the additional work) reasonable opportunity for the introduction and storage of materials and equipment and the execution of work,

and shall properly connect and coordinate the work with theirs.

25.3 If the performance of additional work by the Contractors or the OWNER is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional work. If the Contractor believes that the performance of such additional work by the OWNER or others involves it in additional expense or entitles it to an extension of the Contract time, the Contractor may make a claim thereof as provided in Articles 14 and 15.

26.0 SUBCONTRACTING

26.1 The Contractor may utilize the services of specialty subcontracts on those parts of the work which, under normal contracting practices, are performed by specialty Subcontractors.

26.2 The Contractor shall not award work to Subcontractor(s) in excess of fifty percent (50%) of the Contract price, without prior written approval of the OWNER.

26.3 The Contractor shall be fully responsible to the OWNER for the acts and omissions of its Subcontractors, and of persons either directly or indirectly employed by them, as the Contractor is for the acts and omissions of persons directly employed by it.

26.4 The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the work of Subcontractors and give the Contractor the same power as regards terminating any subcontract that the OWNER may exercise over the Contractor under any provision of the Contract Documents.

26.5 Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the OWNER.

26.6 The Contractor shall supply the names and addresses of subcontractors and material suppliers when requested to do so by the OWNER.

26.7 The Contractor shall not use a subcontractor or material supplier against whom the OWNER has a reasonable objection.

27.0 ENGINEER'S AUTHORITY

27.1 The Engineer shall act as the OWNER's representative during the construction period, shall decide questions which may arise as to quality and acceptability of materials furnished and work performed, and shall interpret the intent of the

Contract Documents in a fair and unbiased manner. The Engineer will be making visits to the site to determine if the work is proceeding in substantial accordance with the Contract Documents.

27.2 The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship, and execution of the work. Inspections may be at the factor or fabrication plant of the source of material supply.

27.3 The Engineer is not responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The Engineer will promptly make decisions relative to interpretation of the Contract Documents.

28.0 LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The Contractor shall provide at its own expense and without liability to the OWNER any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

29.0 GUARANTEE

29.1 The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one year from the date of substantial completion. The Contractor warrants and guarantees for a period of one (1) year from the date of substantial completion of the system that the completed system is free from all defects due to faulty materials of workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of the damage of other parts of the system resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other work that may be made necessary by such defects, the OWNER may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

30.0 ARBITRATION BY MUTUAL AGREEMENT

- 30.1 All claims, disputes, and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by making an acceptance of final payment as provided by Article 20, may be decided by arbitration if the parties mutually agree. Any agreement to arbitrate shall be specifically enforceable under the prevailing arbitration law. The law rendered by the arbitrators shall be final, and judgement may be entered upon it in any court having jurisdiction thereof.
- 30.2 Notice of the request for arbitration shall be filed in writing with the other party to the Contract Documents and a copy filed with the Engineer. Request for arbitration shall in no event be made on any claim, dispute, or other matter in question which would be barred by the applicable statute of limitations.
- 30.3 The Contractor will carry on the work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

31.0 TAXES

- 31.1 The Contractor will pay all sales, consumer, use and other similar taxes required by the laws of the place where the work is performed.

32.0 EXECUTION OF CONTRACT

- 32.1 The party to who each contract is awarded will be required to execute the Agreement within ten calendar days from the date when Notice of Award is delivered to the Bidder. The Notice of Award shall be accompanied by the necessary Agreement. In case of failure of the Bidder to execute the Agreement, the OWNER may at its option consider the Bidder in default.
- 32.2 The OWNER within thirty (30) days of receipt of acceptable Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement. Should the OWNER not execute the Agreement within such period, the Bidder may, by written notice, withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.
- 32.3 The Notice to Proceed shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement of the OWNER and Contractor. If the Notice to Proceed has not been issued within ten (10) day period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

33.0 CONTRACTS AND COOPERATION

33.1 At the same time that work under this contract is being provided at the site, there may be other contractors working on the site. The OWNER reserves the right to award other contracts for work to be constructed at the same time, and in connection with, the work included in this contract.

33.2 The Contractor shall cooperate with all other contractors in such a manner, and to such extent, as best to facilitate the completion of the entire project in the shortest time possible, subject to, at all times, the approval of the Engineer. It shall be the duty of each Contractor to work with the other contractors, render such assistance, and to arrange his work in such a manner that shall allow the entire project to be delivered complete and in the best possible condition.

33.3 The Contractor shall keep himself fully informed at all times regarding all details of the work of other contractors working at the site, and he shall be responsible for all delays that may result from his failure to install his own work in the proper manner and at the proper time.

33.4 The Contractor shall be responsible for coordinating the relocation of existing utilities (with the respective utility companies) as needed to construct the project. The OWNER will pay fees charged by the utility company for relocating these utilities.

34.0 PERMITS

34.1 OWNER will have construction plans approved by the local, OWNER, and the Florida Department of Environmental Protection if required. Contractor will be responsible for conforming with requirements of these approvals.

34.2 The Contractor will procure and pay for all local permits, all special permits (including NPDES), inspection and other charges required in connection with the work and notify all permitting agencies when construction commences.

35.0 SCHEDULE OF WORK

35.1 All work under this contract shall be arranged and be carried out in such a manner as to complete the work on or before the contract completion date. The contractor must notify the OWNER at the time of bidding if the chronology of the work as shown or the subdivision of work will affect warranties or guarantees in any way. No such claims shall be allowed once the work has begun.

35.2 Should the Contractor(s) work, through no fault of the Engineer, the OWNER, or other contractors, fail to progress according to the schedule, and if, in the opinion of the Engineer, the work cannot be completed within the time stated in the contract, or if deemed necessary to protect this or adjoining work from damage, the Contractor shall work such additional time over the established hours of work,

including weekends and Holidays as required to meet the schedule time without additional expense to the OWNER.

35.3 The Contractor is required to furnish adequate manpower at the project to complete the work within the time allowed by the progress schedule. Should payment of premium time, bonuses, or the like be necessary to attract sufficient manpower for the project, such extra labor costs shall be borne by the Contractor without additional compensation from the OWNER.

35.4 When so ordered, in writing, by the Engineer, whether to advance the contract completion date, or for any other reason for the OWNER's benefit, the Contractor shall work overtime and or additional shifts and shall be reimbursed by the OWNER for his actual net premium costs of such overtime and or shifts so ordered and so worked, including insurance and taxes applicable thereto, (without other overhead or profit). Such costs and expenses shall be subject to audit by the OWNER.

35.5 Inclement weather will be reason for granting extension in contract time if the number of days of rain (trace not included) for the period of the Contract is in excess of the average for that period for the past five (5) years. The increase in time shall be one day for each day of inclement weather over the average.

35.6 The time of completion will stop at the date of substantial completion. However, this does not relieve the contractor of finishing the project within a timely manner. If after 30 calendar days from the date of substantial completion, the contractor is not completely finished with the project, the OWNER reserves the right to re-enact the liquidated damage clause for that time over the 30-day period after substantial completion date.

36.0 USE OF SITE

36.1 The Contractor(s) shall confine their use of the site for storage or materials, erection of temporary facilities and parking of vehicles to areas within his Contract limits as directed by the Engineer. The Contractor shall not unnecessarily encumber the premises at any time.

36.2 Areas of the site in which work under this contract may be performed will be used by other contractors for storage of materials, erection of temporary facilities and parking of vehicles. Areas used by other Contractors will be vacated, as directed by the Engineer to permit work under this Contract, provided reasonable notice is given requesting such, all in accordance with this Contractor's construction schedule.

36.3 No signs or advertisements shall be displayed on the site or building except with the written consent of the OWNER.

37.0 TEMPORARY FACILITIES

- 37.1 The Contractor shall provide electric power, water and other utilities as he may require for his construction purposes, and shall pay all costs incurred unless otherwise provided in the Contract Documents. At completion of the contract, all temporary facilities shall be removed from the site.
- 37.2 The Contractor shall provide sanitary facilities for his workmen at all times. Sanitary facilities shall be of an approved chemical type with regular servicing, as approved by the Engineer and Health Authorities.

38.0 PRECAUTIONS

- 38.1 Attention is called to the fact that Contractor is responsible for contacting all utility companies to obtain locations of all existing utilities or obstructions which he may encounter during construction. After location of utilities by the appropriate utility company, it is the Contractor's responsibility to protect all such utility lines, including service lines and appurtenances, and to replace at his own expense any which may be damaged by the Contractor's equipment, or forces during construction of the project.
- 38.2 Barricades, Guards and Safety Provisions: To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns and guards shall be placed and maintained during progress of construction work and until it is safe for both pedestrians and vehicular traffic. Rules and regulations of local authorities regarding safety provisions shall be observed.
- 38.3 Traffic Controls: Trenching and earthwork shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, provide suitable bridges.
- 38.4 Work in Progress: Protect completed work from damage by other work in progress. Maintain such protection as long as work is in progress.

38.5 SPECIAL PRECAUTIONS

- 38.5.1 The Contractor shall at all times during construction activity control turbidity caused by construction related acts, by the placement of containment curtains, hay bales or suitable temporary erosion control barriers. The pumping and discharge of trench water shall be in accordance with all local, State, and Federal agencies which control such activities. Any permits for such activities shall be obtained by the Contractor and the cost of same be included in the bid price

submitted.

39.0 PROJECT LAYOUT AND CONTROL

- 39.1 The OWNER has provided suitable benchmarks and horizontal alignment. These items are shown on the construction drawings. Any of these points which are disturbed or destroyed by the Contractor shall be replaced at the Contractor's expense.
- 39.2 The Contractor shall engage a Professional Land Surveyor registered in the State of Florida to practice land surveying. Said surveyor should carry Professional Liability Insurance. The land surveyor employed for this project must comply with the Minimum Technical Standards for land surveyors in the State of Florida pursuant to Florida Statute 472.027 adopted rule 121HH-6. The Contractor shall be held responsible for all mistakes that may be caused by the loss of disturbance of the Engineer's layout work.
- 39.3 Should the Contractor in the course of the work find that the points, grades and levels which are shown upon the Drawings are not conformable to the physical conditions of the locality at the proposed work or structure, he shall immediately inform the Engineer of the discrepancy between actual physical conditions of the locality of the proposed work, and the points, grades and levels which are shown on the drawings. No claim shall be made by the Contractor against the OWNER for compensation or damage by reasons of failure of the Engineer to represent upon said drawings, points, grades and levels conformable to the actual physical conditions of the locality of the proposed work.

40.0 TESTING

- 40.1 The Contractor will furnish and pay for the services of a qualified independent testing laboratory approved by the Engineer to provide project quality control if required. It is the Contractor's responsibility to notify the Engineer and testing laboratory as items become ready for tests. Retesting of all testing failures shall be at the Contractor's expense. Testing laboratory shall work under direction of the Engineer. Copies of reports of all tests shall be sent to Contractor, Engineer and OWNER.

41.0 DISPOSAL OF WASTE MATERIALS

- 41.1 No burial of waste materials will be permitted on the premises. The Contractor shall at all times keep the premises free from accumulations of waste material or debris caused by his employees or work and shall remove same when necessary or required by the Engineer.

42.0 WARRANTY OF TITLE AND WAIVER OF LIEN

42.1 No material, supplies or equipment for the work shall be purchased by the Contractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants good title to all materials, supplies and equipment installed or incorporated in the work and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by him, to the OWNER free from any claims, liens or charges and further agrees that neither he nor any person, firm, or corporation furnishing any material or labor for any work covered by this contract shall have any right to a lien upon the premises or any improvements or appurtenances thereon as a result of the Contractor's failing in his commitment to the OWNER or any person, firm or corporation furnishing any material or labor for any work covered by this contract. The Contractor shall not at any time suffer or permit any lien, attachment, or other encumbrances under the law of Florida or otherwise by any person or persons whomsoever to remain on file with the OWNER against any money due or to become due for any work done or materials furnished under the contract or by reason of any other claim or demand against the Contractor. Such lien, attachment, or other encumbrance, until it is removed, shall preclude any and all claims or demands for any payment under virtue of the contract.

43.0 OWNERSHIP OF HIDDEN VALUABLE MATERIALS

43.1 If the excavation of this project uncovers treasure or valuable materials of any kind buried or hidden within the work, it shall remain the property of the OWNER, other provisions in the documents to the contrary notwithstanding. Guard same until it is turned over to the OWNER.

44.0 AS-BUILT PLANS

44.1 Before final inspection the Contractor shall turn over to the Engineer a set of marked up drawings showing field changes and actual installed conditions. This also includes electrical conduit and valve references with no less than two (2) distances to permanent objects, signed and sealed by a professional land surveyor registered in the State of Florida.

45.0 CLEAN UP

45.1 Before final inspection and acceptance of the work, the Contractor shall clean ditches, shape shoulders and restore all disturbed areas, including street crossings, grass plots, re-grassing if necessary, to as good condition as existed before work started.

46.0 SILENCE OF SPECIFICATIONS

- 46.1 The apparent silence of these specifications and supplemental specifications as to any details or the omission from it of a detailed description concerning any point shall be regarded as meaning that all work shall be performed in accordance with the Florida DOT Standard Specifications for Road and Bridge Construction, latest Edition.

47.0 CONFLICT OF INTEREST

- 47.1 Unacceptable bidders. An Engineer (individual or firm including persons they employ) who has prepared plans and specifications will not be considered an acceptable bidder. Any firm or corporation in which such Engineer including persons they employ) is an officer, employee or holds or controls a substantial interest will not be considered an acceptable bidder. Contracts or purchases by the Contractor shall not be awarded or made to a supplier or manufacturer if the Engineer (firm or individual) who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Bids will not be awarded to firms or corporations which are owned or controlled wholly or in part by a member of the governing body of the OWNER or to an individual who is such a member.
- 47.2 The OWNER's officers, employees, or agents shall not engage in the award of administration of the Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (a) the employee, officer or agent; (b) any member of their immediate family; (c) their partner or (d) an organization which employs, or is about to employ, any of the above has financial or interest in the Contractor. The OWNER's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from the Contractor or subcontractor.

48.0 GRATUITIES

- 48.1 If the OWNER finds after a notice and hearing that the Contractor, or any of the Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts (or otherwise) to any official, employee, or agent of the OWNER, the State, or other officials in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, the OWNER may, by written notice to the Contractor, terminate this Contract. The OWNER may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which the OWNER bases such findings shall be an issue and may be reviewed in proceedings under the Remedies Clause of this Contract.
- 48.2 In the event this Contract is terminated as provided in paragraph 48.1 above, the OWNER may pursue the same remedies against the Contractor as it could pursue in the event of a breach of the Contract by the Contractor. As a penalty, in

addition to any other damages to which it may be entitled by law, the OWNER may pursue exemplary damages in an amount (as determined by the OWNER) which shall be not less than three nor more than ten times the costs the Contractor incurs in providing any such gratuities to any such officer or employee.

49.0 PROTECTION OF LIVES AND PROPERTY

49.1 In order to protect the lives and health of its employees under the Contract, the Contractor shall comply with all pertinent provisions of the Occupational Safety and Health Administration (OSHA) and any State Safety and Health agency requirements.

49.2 The Contractor alone shall be responsible for the safety, efficiency, and adequacy of its plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance or operation.

50.0 AUDIT AND ACCESS TO RECORDS

50.1 For all negotiated contracts (except those of \$10,000 or less), the OWNER or any of their duly authorized representatives, shall have access to any books, documents, papers and records of the Contractor, which are pertinent to the Contract, for the purpose of making audits, examinations, excerpts and transcriptions. The Contractor shall maintain all required records for three years after final payment is made and all other pending matters are closed.

51.0 CERTIFICATE OF OWNER'S ATTORNEY

I, the undersigned _____ the duly authorized and acting representative of the **PROJECT OWNER** do hereby certify as follows:

I have examined the attached Contract(s) and Performance and Payment Bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with terms, conditions, and provisions thereof.

OWNER Attorney

END OF SECTION 00700

SUPPLEMENTARY CONDITIONS

SECTION 00800

PART 1 - GENERAL

1.1 INSURANCE

Before any work at the site is started, Contractor shall deliver to OWNER, with a copy to Engineer, Certificates of Insurance which contractor is requested to purchase and maintain in accordance with the requirements of the General Conditions.

1.2 PROPERTY INSURANCE

Unless otherwise provided in these Supplementary Conditions, Contractor shall purchase and maintain property insurance upon the work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in these Supplementary Conditions or required by law). This insurance shall include the interests of OWNER, Contractor, Sub-contractors, Engineer and Engineer's Consultants in the work, all of whom shall be listed as insured or additional insured parties, shall insure against perils of fire and extended coverage, shall include "all risk" insurance for physical loss and damage including theft, vandalism and malicious mischief, collapse and water damage, and such other perils and shall include damages, losses and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals). If not covered under the "all risk" insurance or otherwise provided, Contractor shall purchase and maintain similar property insurance on portions of the work stored on and off site or in transit when such portions of the work are to be included in an Application for Payment. The policies of insurance required to be purchased and maintained by Contractor shall contain a provision that the coverage afforded will not be canceled or materially changed until at least 15 days prior written notice has been given to OWNER.

1.3 CONTRACT DOCUMENTS

Should a conflict exist within the contract documents, the precedence in ascending order of authority is as follows:

1. Change Order
2. Addenda
3. Plans
4. Specifications

1.4 CLAIM PERIOD

No claim of the Contractor shall be allowed unless 1) Contractor has given written notice within 14 days of the incident, and 2) within thirty days after Contractor has given the written notice, Contractor submits to OWNER a detailed claim setting forth Contractor's right to recover any additional costs and lost time as provided in the General Conditions. No claim by the Contractor for an equitable adjustment hereunder shall be allowed if asserted after final payment under this Contract.

1.5 REGULAR WORKING HOURS

- A. Regular working hours are defined as up to eight hours per day, Monday through Friday, beginning no earlier than 7:00 A.M. and ending no later than 7:00 P.M., excluding holidays. Whenever the Contractor is performing any part of the work, with the exception of equipment maintenance and cleanup, OWNER's representative and/or inspection will be required. Requests to work other than regular working hours must be submitted to the OWNER's designated representative, at least 24 hours prior to any proposed weekend work or scheduled extended workweeks, to give the OWNER ample time to arrange for representation and/or inspection during those periods. Periodic unscheduled overtime on weekdays will be permitted provided that two hours notice is provided to the OWNER's designated representative. Maintenance and cleanup may be performed during hours other than regular working hours.
- B. Contractor shall reimburse the OWNER for additional engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours. At OWNER's option, overtime costs may either be deducted from the Contractor's monthly payment request or deducted from the Contractor's retention prior to release of final payment. Engineering/Inspection costs shall be calculated at the following rates:

Field Representative	\$75/hour
Engineer	~~\$75-85~~ 125/hour

1.6 SUBSTITUTIONS

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.

1.7 SUBCONTRACTORS

A sub-contractor or other person or organization identified in the Contractor's bid and not objected to in writing by OWNER or Engineer prior to the execution of the Agreement will be deemed acceptable to OWNER and Engineer. All other sub-contractors shall be deemed to have been accepted if OWNER or Engineer deliver no written objection thereto within 15 days after Contractor's written identification of such sub-contractor. However, if OWNER or Engineer has reasonable objection to any sub-contractor, wherever identified in the Bid or subsequently, Contractor shall submit an acceptable substitute without entitlement to any change in Contract Price. After acceptance by the OWNER or Engineer of any particular sub-contractor, the Contractor shall make no substitution without written approval of the OWNER, which may be granted or withheld at OWNER's sole discretion. No acceptance by OWNER or Engineer of any such sub-contractor, supplier or other person or organization shall constitute a waiver of any right of OWNER or Engineer to reject defective work.

1.8 CHANGES IN WORK

At any time Engineer may request a quotation from Contractor for a proposed change in the work. Within 10 calendar days after receipt of a request for a quotation for a proposed change, Contractor shall proceed to 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 10 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. Itemized estimates shall be in sufficient detail reasonably to 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. Any amount claimed for subcontracts shall be similarly supported. Itemized scheduled adjustments shall be in sufficient detail to permit an analysis of impact. 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 not be considered as basis for a time extension.

1.9 WRITTEN NOTICE

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 and to Engineer promptly (but in no event later than fourteen days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within thirty days after such occurrence.

1.10 DEFECTIVE WORK

The Contractor shall not be entitled to an extension of the Contract Time for correcting or removing defective work.

1.11 CORRECTIVE WORK

- A. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any special guarantee required by the contract documents or by any specific provision of 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: (i) correct such defective work, or, if it has been rejected by OWNER, remove it from the site and replace it with work that is not defective, and (ii) satisfactorily correct or remove and replace any damage to other work or the work of others resulting therefrom. If Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risks of loss or damage, OWNER may have the defective work corrected or the rejected work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- B. Where defective work (and damage to other work resulting therefrom) has been corrected, removed or replaced, the correction period hereunder with respect to such work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

1.12 STATUS REPORTS

The Contractor shall provide "Weekly Progress Status Report" to the OWNER prepared per the requirements of the contract documents or verbally as may agreed upon by the OWNER's Project Manager.

1.13 STORED EQUIPMENT AND MATERIALS

The Contractor shall furnish evidence that payment received on the basis of materials and equipment, not incorporated and suitably stored, has in fact been paid to the respective supplier(s) within two (2) days of the Application of Payment on which the material/equipment first appeared. Failure to procure said evidence of payment shall result in the withdrawal of previous approval(s) and removal of the related equipment and materials from the Application of Payment.

1.14 SUBCONTRACTOR OBLIGATIONS

Notwithstanding any other provision of these Contract Documents to the contrary, OWNER and Engineer are under no duty or obligation whatsoever to any Sub-contractor, laborer or other party to ensure that payments due and owing by the Contractor to any of them will be made. Such parties shall rely only on the Contractor's surety bonds for remedy of nonpayment by the Contractor.

1.15 SUBSTANTIAL COMPLETION

The Work will be considered substantially complete when each of the following portions of the Work is completed to the satisfaction of the OWNER:

- 1.) all components of the Work have been installed, tested and approved.
- 2.) record drawings and other "as-built" information have been provided in accordance with the Contract Documents.
- 3.) all private property has been restored.
- 4.) 75% of all sodding or hydroseeding is completed, and all pavement patches are completed.

END OF SECTION 00800

SECTION 00841

NOTICE OF AWARD FORM

(Contractor)

Date: _____

Project: **South Columbia County Regional Wastewater Treatment Plant**

Date of Bid Opening: _____

You are notified that your bid dated _____ for the above Contract has been considered and the OWNER, expects to award you a contract for:

Columbia County Wastewater Treatment Facility Project, consisting of

- Construction of a .16 million gallon per day (MGD) SBR treatment facility, consisting of a dual tank reactor, an equalization tank, a digester with blower, two sludge drying beds, one chlorine contact chamber, a ground storage tank, two sand filters, one blower building with three blowers, one chlorine building with two tanks and pumping equipment, an effluent pump station and back-up generator, an administration building and various pumps, yard piping and electrical equipment.

(Indicate total Work, Alternates or Sections of Work Awarded)

The Contract Price of your contract is _____
Dollars and _____ cents.

Six (6) copies of each of the following proposed Contract Documents (except Project Manual and Drawings) accompany this Notice of Award:

- Agreement Between Owner and Contractor
- Performance Bond
- Payment Bond
- Notice of Award

You must comply with the following conditions precedent to the award of the contract within ten (10) days of the date of the Notice of Award, that is by _____, 20__.

1. You must deliver to the OWNER three (3) fully executed counterparts of the Agreement.

2. You must deliver with the executed Agreement six (6) completed original documents with original signatures on the Payment and Performance Bond in the form specified in the Bidding Documents.
3. You must provide in writing the correct name and address of the surety which is providing the Payment and Performance Bonds and the correct name and address of the surety's resident agent for service of process in Florida.
4. You must deliver with the executed Agreement six (6) completed, with original signatures, Certificates and Endorsements of Insurance in the form specified in the Bidding Documents.

Failure to comply with these conditions within the time specified will entitle the OWNER to consider your Bid abandoned, to annul this Notice of Award, and to declare your Bid Security forfeited.

Within ten (10) days after you comply with these conditions, the OWNER will return to you one (1) fully signed counterpart of the Agreement with the Contract Documents attached.

OWNER:

ACCEPTANCE OF AWARD:

Columbia County

(Contractor)

(Authorized Signature)

(Address)

(Title)

(Authorized Signature
Acknowledge Receipt of Notice)

Acct. No.: _____

(Title)

(Date)

Copy to Eutaw Utilities, Inc.

SECTION 00842

NOTICE TO PROCEED FORM

Contractor

Date: _____

Notice to Proceed on Project: **South Columbia County Regional Wastewater Treatment Plant**

You are notified that the Contract Time under the above contract will commence to run on_____. On that date you are to start performing the Work and your other obligations under the Contract Documents. Based on the Contract Time stated in the Agreement, we calculate that the dates of Substantial Completion and Final Completion are _____, and _____, respectively.

Work at the site must be started by _____ as indicated in the Contract Documents.

OWNER:

BY:

Columbia County

(Contractor)

P. O. Box 1529
Lake City, FL 32056-1529
(Address)

(Address)

(Authorized Signature)

(Authorized Signature
Acknowledge of Receipt of Notice)

(Title)

(Title)

(Date)

Copy to: Eutaw Utilities, Inc.

CHANGE ORDER

062109

APPLICATION AND CERTIFICATE FOR PAYMENT

AIA Document G702

PAGE 0 of 2

TO (CLIENT):
COLUMBIA COUNTY

PROJECT:
ColumbiaCounty
Wastewater Facility Project

APP NUMBER:

Distribution to:

- ☐ COLUMBIA COUNTY
☐ EUTAW UTILITIES, INC
☐

FROM (Contractor):**PAYMENT DUE:**

CONTRACT DATE:

CONTRACT FOR: Construction

CONTRACTOR'S APPLICATION FOR PAYMENT

Change Order Summary			
Total Change Orders approved by Owner		ADDITIONS	DEDUCTIONS
		\$ -	\$ -
Number	Date Approved		
01		\$ -	\$ -
02		\$ -	\$ -
03		\$ -	\$ -
04		\$ -	\$ -
05		\$ -	\$ -
06		\$ -	\$ -
14		\$ -	\$ -
15		\$ -	\$ -
Net change by Change Orders		\$ -	\$ -

Application is made for Payment, as shown below in connection with the Contract.

Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM.....	\$ -
2. Net Change by Change Orders.....	\$ -
3. CONTRACT SUM TO DATE (Line 1 + 2).....	\$ -
4. TOTAL COMPLETED AND STORED TO DATE.....	
5. LESS PREVIOUS CERTIFICATES FOR PAYMENT	\$ -
6. CURRENT BALANCE DUE.....	\$ -
7. BALANCE TO FINISH.....	

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

By: _____ Date: _____

State of: Florida County of: _____
Subscribed and sworn to before me this _____ day of _____.

Notary Public: _____
My Commission expires: _____

Eutaw Utilities, Inc.

**APPROVAL FOR PAYMENT
OWNER'S REPRESENTATIVE**

**APPROVAL FOR PAYMENT
OWNER**

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

Client: COLUMBIA COUNTY
 Client Rep: EUTAW UTILITIES, INC
 Contractor

SECTION 00845 - SCHEDULE OF CONTRACT VALUES

(AIA DOCUMENT G703 SIMILAR)

COLUMBIA COUNTY WASTEWATER FACILITY PROJECT

A ITEM NO.	B DESCRIPTION OF WORK	C SCHEDULED VALUE				D WORK COMPLETED				E TOTAL COMPLETE & STORED TO DATE			I BALANCE TO FINISH
		QTY	U/M	UNIT COST	VALUE	PREVIOUS QTY CONSUMED	PREVIOUS COST	CURRENT QTY CONSUMED	CURRENT COST	TOTAL QTY CONSUMED	TOTAL COST	% COMPL	
	PROJECT ADMINISTRATION												
001		1		\$ -	\$ -					0.000	\$ -		\$ -
002		1		\$ -	\$ -					0.000	\$ -		\$ -
003		1		\$ -	\$ -					0.000	\$ -		\$ -
004		1		\$ -	\$ -					0.000	\$ -		\$ -
	Subtotal				\$ -		\$ -		\$ -		\$ -		\$ -
	ENGINEERING SERVICES												
005		1		\$ -	\$ -					0.000	\$ -		\$ -
006		1		\$ -	\$ -					0.000	\$ -		\$ -
007		1		\$ -	\$ -					0.000	\$ -		\$ -
	Subtotal				\$ -		\$ -		\$ -		\$ -		\$ -
	BID CAT												
008		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
009		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
010		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
011		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
012		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
013		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
014		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
015		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
045		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
046		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
047		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
048		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
049		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
050		1		\$ -	\$ -		\$ -			0.000	\$ -		\$ -
	Subtotal				\$ -		\$ -		\$ -		\$ -		\$ -
							END OF SECTION						

SECTION 00846

MATERIALS STORED ON SITE FORM

Pay Estimate No. _____	Project _____	Date Prepared _____
For Period Ending _____	Prepared by _____	Page _____ of _____

A	B	Value Last Period			(-) Value Mat'l Installed			(+) Value Mat'l Delivered			Value This Period		
		C	D	E	F	G	H	I	J	K	L	M	N
Item	Description	Quantity	Unit Price	Invoice Amount	Quantity	Unit Price	Invoice Amount	Quantity	Unit Price	Invoice Amount	Quantity	Unit Price	Invoice Amount

SECTION 00847

SHOP DRAWING SUBMITTAL FORM

Owner: Columbia County
P.O. Box 1529
Lake City, FL 32056-1529

Specification No.: _____
 Project: Columbia County
Wastewater Facility Project

Contractor: _____

FOR EUI USE ONLY**DATE RECEIVED****DATE RETURNED**

Project No.: _____

Owner's
 Project No.: _____

Contractor's
 Submittal No.: _____

Contractor's
 Project No.: _____

Resubmittal Yes _____ No _____

ITEM NO	RESUBMITTAL NO.	NO. COPIES	VENDOR	DESCRIPTION	ENGINEER'S ACTION

ACTION CODE (As defined in the General Conditions)

A APPROVED
 AN APPROVED AS NOTED
 AR AMEND AND RESUBMIT
 R REJECTED

(DO NOT ORDER OR FABRICATE UNTIL APPROVED)

SUBMITTED BY: _____
Contractor

DATE: _____

ENGINEERS COMMENTS:

Discipline Review:

Distribution

- Contractor _____ Copies
- Owner _____ Copies
- EUI Office _____ Copies

Reviewed By _____ Date _____

Discipline Review:

Reviewed By _____ Date _____

Project Manager _____ Date _____

SECTION 00848

CERTIFICATE OF SUBSTANTIAL COMPLETION

OWNER'S Project No.: _____

South Columbia County Regional

Wastewater Treatment Plant

CONTRACTOR _____

Contract Date _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof.

To Columbia County _____
Owner

And To _____
Contractor

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

Date of Substantial Completion

Certificate of Substantial Completion
Page 1 of 3

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 therein does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract documents. When this Certification applies to a specified part of the Work the items in the tentative list shall be completed or corrected by CONTRACTOR within _____ days of the above date of Substantial Completion.

The date of Substantial Completion is the date upon which all guarantees and warranties begin, except as follows:

The responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, heat, utilities and insurance shall be as follows:

RESPONSIBILITIES:

OWNER_____

CONTRACTOR_____

The following documents are attached to and made a part of this Certificate:

Certificate of Substantial Completion
Page 2 of 3

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR'S obligation to complete the Work in accordance with the Contract Documents.

Executed by ENGINEER on _____.

Eutaw Utilities, Inc.
(Engineer)

By_____

The CONTRACTOR accepts this Certificate of Substantial Completion on:

_____, 20__.

(Contractor)

By_____

Certificate of Substantial Completion
Page 3 of 3

SECTION 00849

CONTRACTOR'S FINAL RELEASE OF LIEN

Before me the undersigned authority in said County and State, appeared _____ who, being first duly sworn, deposes and says that he is _____ of _____, a company and/or corporation authorized to do business under the laws of Florida, which is the Contractor on the Contract described as: _____ dated the _____ day of _____, 20____, that the said deponent is duly authorized to make this affidavit by resolution of the Board of Directors of said company and/or corporation; that deponent knows of his own knowledge that said Contract has been complied with in every particular by said Contractor and that all parts of the work have been approved by the Owner's Engineers; that there are no bills remaining unpaid for labor, material, or otherwise, in connection with said Contract and work, and that there are no suits pending against the undersigned as Contractor or anyone in connection with the work done and materials furnished or otherwise under said Contract. Deponent further says that the final estimate which has been submitted to the owner simultaneously with the making of the affidavit constitutes all claims and demands against the Owner on account of said Contract or otherwise, and the acceptance of the sum specified in said final estimate will operate as a full and final release and discharge of the Owner from any further claims, demands or compensation by Contractor under the above Contract. Deponent further agrees that all guarantees under this Contract shall be in full force from the date of this release as spelled out in the Contract Documents.

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

Notary Public

My Commission Expires _____

We, the _____ having heretofore executed a Performance Bond for the above-mentioned Contractor covered Project and Section as described above in the sum of _____ dollars (\$_____), hereby agree that the Owner may make full payment of the final estimate, including the retained percentage, to said Contractor.

It is fully understood that the granting of the right to the Owner to make payment of the final estimate to said Contractor and/or his assigns, shall in no way relieve the surety company of its obligations under its bond, as set forth in the Specifications, Contract and Bond pertaining to the above Project.

IN WITNESS WHEREOF, the _____ has caused this instrument to be executed on its behalf by its _____ and/or its duly authorized attorney in fact, and its corporate seal to be hereunto affixed, all of this _____ day of _____, A.D., 20_____.

Surety Company

Attorney in Fact

(Power of Attorney must be attached if executed by Attorney in Fact)

STATE OF FLORIDA

COUNTY OF _____

Before me the undersigned authority, personally appeared to me well known as the person described in and who executed the foregoing instrument in the name of _____ and/or _____ purpose therein expressed and that he had due and legal authority to execute the same on behalf of said _____, a corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal at _____ this _____ day of _____, 20_____.

Notary Public

END OF SECTION

SECTION 00850

FIELD ORDER

☐	OWNER:	<u>Columbia County</u>	No. Copies	_____	
☐	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies	_____	
☐	ARCHITECT:	_____	No. Copies	_____	FIELD ORDER
☐	CONTRACTOR:	_____	No. Copies	_____	NO. _____
☐	FIELD	_____	No. Copies	_____	
☐	OTHER:	_____	No. Copies	_____	

PROJECT DATA

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

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPECIFICATION SECTION: _____

To: (Contractor)

You are hereby directed to execute promptly this Field Order which interprets the Contract Documents or orders minor changes in the Work without change in Contract Sum or Contract Time.

If you consider that a change in Contract Sum or Contract Time is required, please submit your itemized proposal to the Engineer immediately and before proceeding with this Work. If your proposal is found to be satisfactory and in proper order, this Field Order will in that event be superseded by a Change Order.

Description (of interpretation or change): _____

Attachments (listing of attached documents that support description):

1. Contractor Request for Information No.: _____
2. _____
3. _____
4. _____
5. _____

EUTAW UTILITIES, Inc.

PROJECT NO: _____

BY: _____

DATE: _____

END OF SECTION

SECTION 00851

CONTRACTOR REQUEST FOR INFORMATION

☐	OWNER:	<u>Columbia County</u>	No. Copies	_____	CONTRACTOR REQUEST FOR INFORMATION NO. _____
☐	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies	_____	
☐	ARCHITECT:	_____	No. Copies	_____	
☐	CONTRACTOR:	_____	No. Copies	_____	
☐	FIELD	_____	No. Copies	_____	
☐	OTHER:	_____	No. Copies	_____	

PROJECT DATA

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

CONTRACT DATA

NUMBER: _____
DATE: _____
DRAWING NO: _____
SPECIFICATION SECTION: _____

QUESTION:

BY: _____

DATE: _____

REPLY:

BY: _____

DATE: _____

END OF SECTION

SECTION 00852

CONSTRUCTION ACCIDENT REPORT

[] OWNER:	<u>Columbia County</u>	No. Copies	_____	CONSTRUCTION ACCIDENT REPORT NO. _____
[] ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies	_____	
[] ARCHITECT:	_____	No. Copies	_____	
[] CONTRACTOR:	_____	No. Copies	_____	
[] FIELD	_____	No. Copies	_____	
[] OTHER:	_____	No. Copies	_____	

PROJECT DATA

NAME:	_____	CONTRACTOR:	_____
LOCATION:	_____	SUBCONTRACTOR:	_____
OWNER:	_____	OTHER:	_____
ENGINEER:	_____		

ACCIDENT INFORMATION

Accident Date: _____ Time: _____
Name(s) of Injured or Deceased: _____

Describe what occurred: _____

NOTE: Use other side or attach additional sheets as required.

Names & Address of Witnesses: _____

Employer's Name & Address: _____

Where treated (Name & Address): _____

Attach sketch if applicable)

Send original to Project Manager in charge
of Construction immediately.

Signed

END OF SECTION

SECTION 00853

PRESSURE TEST FORM

[]	OWNER:	<u>Columbia County</u>	No. Copies	_____	
[]	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies	_____	PRESSURE
[]	ARCHITECT:	_____	No. Copies	_____	TEST
[]	CONTRACTOR:	_____	No. Copies	_____	NUMBER_____
[]	FIELD:	_____	No. Copies	_____	
[]	OTHER:	_____	No. Copies	_____	

PROJECT DATA:

Name:	_____	Owner:	_____
Location:	_____	Contractor:	_____
Number:	_____	Subcontractor:	_____
Date:	_____		

LOCATION OF TEST:

COMPUTATION FOR MEASURED LEAKAGE:

Time-End of Test	_____	Pressure-End of Test (psi)	_____
Time-Start of Test	_____	Pressure-Start of Test (psi)	_____
Test Time (Hours)	_____	Average Test Pressure (psi)	_____
Pipe Material	_____		
Quantity of Water Required to Return to Original Pressure (gals.)	_____		
Location of Pipe Being Tested	_____	Start pt.	_____
		End pt.	_____

Computation for Allowable Leakage (for Ductile Iron Pipe):

D	=	Size of Line Tested:	Diameter (inches)
S	=	Length of Pipe Tested:	(feet)
T	=	Test Time:	(hours)
P	=	Average Test Pressure:	(psi)
Q	=	Allowable Leakage:	$\frac{S \times D \times (P)^{\frac{1}{2}} \times T}{133,200}$ (gal.) Per AWWA Std. C600

Allowable Leakage for PVC pipe shall be 90% of value calculated above.

[illegible]

TEST WITNESS

by EUI

062109

SECTION 00855

HYDRAULIC TEST ON CONCRETE
TANKAGE FORM

[]	OWNER:	<u>Columbia County</u>	No. Copies _____	HYDRAULIC TEST OF CONCRETE TANKAGE TEST NO. _____
[]	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies _____	
[]	ARCHITECT:	_____	No. Copies _____	
[]	CONTRACTOR:	_____	No. Copies _____	
[]	FIELD:	_____	No. Copies _____	
[]	OTHER:	_____	No. Copies _____	

PROJECT DATA:

CONTRACT DATA

NAME: _____

NUMBER: _____

LOCATION: _____

DATE: _____

OWNER: _____

DRAWING NO.: _____

CONTRACTOR: _____

SPECIFICATION
SECTION: _____

1. LOCATION OF TEST

2. TANK DATA: SIZE _____ WATER DEPTH _____ (FT)

3. PRE-INSPECTION

TANK CLEAN _____ YES _____ NO _____

DAYS LAPSED SINCE LAST POUR _____

BACKFILL IN PLACE _____

OTHER COMMENTS _____

4. TESTING: DATE FILING STARTED: _____, 20_____

FILL RATE NOT TO EXCEED 18 INCHES PER DAY

DAY	(1)	____"	(2)	____"	(3)	____"	(4)	____"
	(5)	____"	(6)	____"	(7)	____"	(8)	____"
	(9)	____"	(10)	____"	(11)	____"	(12)	____"

(13) _____", (14) _____", (15) _____", (16) _____",

DATE FILLING COMPLETE:: _____, 20_____
ADD TWO (2) DAYS FOR WATER ABSORPTION

DATE TEST STARTED:: _____, 20_____
5-DAY DROP IN WATER LEVEL

(1) _____", (2) _____", (3) _____", (4) _____", (5) _____"

COMPUTATION OF WATER LOSS (GALLONS/DAY)*

MAXIMUM ALLOWABLE LEAKAGE RATE: 1/10 OF 1% OF NORMAL TANK
VOLUME IN 24 HRS.

5. REMARKS: _____

6. ON REVERSE SIDE OF THIS FORM, SKETCH TANK PLAN AND INDICATE
LOCATION OF OBSERVED LEAKS (DEGREES FROM NORTH CW), QUANTIFY
EACH LEAK AND DESCRIBE (LENGTH, WIDTH, UNIFORM, JAGGED, ETC.)

TEST WITNESS

THE ABOVE TEST
(DOES) (DOES NOT)
MEET THE
SPECIFICATION

by Contractor

by Subcontractor

by Engineer

END OF SECTION

WORK DIRECTIVE FORM

062109

Estimated increase (decrease) in Contract Price.
\$ _____

If the change involves an increase, the
estimated amount is not to be exceeded
without further authorization.

Estimated increase (decrease) in Contract
Times.

Substantial Completion _____ days;
Ready for final payment _____ days.
If the change involves an increase, the
estimated times are not to be exceeded
without further authorization.

RECOMMENDED:

BY: _____
(Engineer)

AUTHORIZED:

BY: _____
(Owner)

Attachments (listing of attached documents that support description):

1. Contractor Request for Information No.: _____
2. Request for Proposal for Proposed Change (RFP) No.: _____
3. _____
4. _____
5. _____

END OF SECTION

EUTAW UTILITIES DAILY CONSTRUCTION REPORT

[illegible]

EUTAW UTILITIES DAILY CONSTRUCTION REPORT

Date:	Project ID: Columbia County Wastewater Facility Project	Inspector:

Estimated Work Performed				
Cont/Sub #	Pay Item	Description	Installed	
			Quantity	Units

EFFECT OF WEATHER ON MAJOR WORK ITEMS

Major and/or controlling work items	No Effect All Day	Effected Less Than 50% of Work Day	Effected More Than 50% of Work Day	No Work All Day

Contractor Performance
Pursuit of Work:
Conformance with Contract Documents:

Signatures

Inspector:
Date

Engineer in Charge:
Date

SECTION 00863

CHANGE PROPOSAL SUMMARY FORM

☐	OWNER:	<u>Columbia County</u>	No. Copies	_____	CHANGE PROPOSAL SUMMARY NO. _____
☐	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies	_____	
☐	ARCHITECT:	_____	No. Copies	_____	
☐	CONTRACTOR:	_____	No. Copies	_____	
☐	FIELD:	_____	No. Copies	_____	
☐	OTHER:	_____	No. Copies	_____	

PROJECT DATA:

CONTRACT DATA

NAME: _____
 LOCATION: _____
 OWNER: _____
 CONTRACTOR: _____

NUMBER: _____
 DATE: _____
 DRAWING NO.: _____
 SPECIFICATION
 SECTION: _____

REFERENCE: Work Directive No. _____ RFP No. _____
 Field Order No. _____ Other _____

DESCRIPTION: _____

PRICING INFORMATION

1.	DIRECT LABOR	Skill/Trade	Manhours	Rate	Cost
1.A	Production Labor	_____	_____	_____	_____
1.B.	Supervision		_____	_____	_____
	☐ Foreman				
	☐ Superintendent				
1.C	Field Engineering		_____	_____	_____
1.D	Expenses		_____	_____	_____
					Subtotal(1)

2. MATERIALS & EQUIPMENT

SECTION 00864

REQUEST FOR PROPOSAL FOR PROPOSED CHANGE FORM

[]	OWNER:	<u>Columbia County</u>	No. Copies _____	REQUEST FOR
[]	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies _____	PROPOSAL
[]	ARCHITECT:	_____	No. Copies _____	FOR PROPOSED
[]	CONTRACTOR:	_____	No. Copies _____	CHANGE (RFP)
[]	FIELD:	_____	No. Copies _____	NO. _____
[]	OTHER:	_____	No. Copies _____	

PROJECT DATA:

CONTRACT DATA

NAME: _____
LOCATION: _____
OWNER: _____
CONTRACTOR: _____

NUMBER: _____
DATE: _____
DRAWING NO.: _____
SPECIFICATION
SECTION: _____

TO: (Contractor) _____

Provide the undersigned a proposal for the following change in the work within seven (7) calendar days after receipt of this request. The written proposal must clearly delineate the scope of the proposed change in work providing an itemized estimate of time and all material and labor (by trade), subcontract and overhead costs and fees. Any amount claimed for subcontracts must be similarly supported.

Description of change in work:

Change Order Type: (Deletion) (Addition) (Revision)

Constraints of Change: _____

Initiated by: _____

Proposal must be received by: _____ (7 days from date below)

Attachments (listing of attached documents that support
 description):

1. Contractor Request for Information No.: _____
2. _____
3. _____
4. _____
5. _____

EUTAW UTILITIES, Inc.

PROJECT NO.: _____

Issued By: _____

DATE: _____

END OF SECTION

SECTION 00865

CHECK OUT FORM

[]	OWNER:	<u>Columbia County</u>	No. Copies _____	
[]	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies _____	CHECK-OUT
[]	ARCHITECT:	_____	No. Copies _____	
[]	CONTRACTOR:	_____	No. Copies _____	MEMO NO. _____
[]	FIELD:	_____	No. Copies _____	
[]	OTHER:	_____	No. Copies _____	

PROJECT DATA:

CONTRACT DATA

NAME: _____
 LOCATION: _____
 OWNER: _____
 CONTRACTOR: _____

NUMBER: _____
 DATE: _____
 DRAWING NO.: _____
 SPECIFICATION
 SECTION: _____

Name of equipment checked: _____

Name of manufacturer of equipment: _____

1. The equipment furnished by us has been checked on the job by us. We have reviewed (where applicable) the performance verification information submitted to us by the Contractor.
2. The equipment is properly installed, except for items noted on page 00865-2.
3. The equipment is operating satisfactorily, except for items noted on page 00865-2.
4. The written operating and maintenance information (where applicable) has been presented to the Contractor, and gone over with him in detail. Five (5) copies of all applicable operating and maintenance information and parts lists have been furnished to him.

Checked By: _____
 Name of Manufacturer's Rep. _____
 Address and Phone # of Rep. _____
 Sig./Title/Person Making Check _____
 Date Checked _____

_____ Name of General Contractor
 _____ Authorized Sign./Title/Date
 _____ Name of Subcontractor
 _____ Authorized Sig./Title/Date

[illegible]

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

END OF SECTION

SECTION 00866

CERTIFICATE OF COMPLETED DEMONSTRATION FORM

[]	OWNER:	<u>Columbia County</u>	No. Copies _____	CERTIFICATE
[]	ENGINEER:	<u>Eutaw Utilities, Inc.</u>	No. Copies _____	OF COMPLETED
[]	ARCHITECT:	_____	No. Copies _____	DEMONSTRATION
[]	CONTRACTOR:	_____	No. Copies _____	MEMO NO. _____
[]	FIELD:	_____	No. Copies _____	
[]	OTHER:	_____	No. Copies _____	

PROJECT DATA:

CONTRACT DATA

NAME: _____
LOCATION: _____
OWNER: _____
CONTRACTOR: _____
EQUIPMENT _____
MANUFACTURER _____

NUMBER: _____
DATE: _____
DRAWING NO.: _____
SPECIFICATION
SECTION: _____

NOTE TO CONTRACTOR:

Submit five (5) copies of all information listed below for checking at least one (1) week before scheduled demonstration of the Work. After all information has been approved by the Engineer, give the Owner a Demonstration of Completed Systems as specified and have the Owner sign five (5) copies of this form. After this has been done, a written request for a final inspection of the system shall be made.

MEMORANDUM:

This memo is for the information of all concerned that the Owner has been given a Demonstration of Completed Systems on the work covered under this Specification Section. This conference consisted of the system operation, a tour on which all major items of equipment were explained and demonstrated, and the following items were given to the Owner:

- (a) Owner's copy of Operation and Maintenance Manual for equipment or systems specified under this section containing approved submittal sheets on all items, including the following:
- (1) Maintenance information published by manufacturer on equipment items.
 - (2) Printed warranties by manufacturers on equipment items.
 - (3) Performance verification information as recorded by the Contractor.

- (4) Check-Out Memo on equipment by manufacturer's representative.
- (5) Written operating instructions on any specialized items.
- (6) Explanation of guarantees and warranties on the system.
- (b) Prints showing actual "As-Built" conditions.
- (c) A demonstration of the System in Operation and of the maintenance procedures which will be required.

(Name of General Contractor)

By: _____
(Authorized Signature, Title & Date)

(Name of Subcontractor)

By: _____
(Authorized Signature, Title & Date)

Operations and Maintenance Manual, Instruction Prints, Demonstration & Instruction in Operation Received:

Columbia County
(Name of Owner)

By: _____
(Authorized Signature, Title & Date)

END OF SECTION

SECTION 01000

PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: 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. The summary of the Work is presented in Section 01010: Summary of Project.
- B. Work Included:
 - 1. The Contractor shall furnish all labor, superintendence, materials, plant power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits and NPDES permit. The Contractor 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.
 - 2. The cost of incidental work described in these Project 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.
 - 3. 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:

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, 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, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.
2. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.
3. 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 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 shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.
4. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor 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 therefor.
5. 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 Drawings 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 paid for as extra work as provided in the Agreement.

6. The Contractor shall, at all times in performance of the Work, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, public utility services, and shall cooperate fully with the owners thereof to that end.
7. 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 48-hours in advance of breaking ground in any area or on any unit of the Work.
8. 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 owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

- A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.
- B. Supplementary Drawings:
 1. 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 the Contractor will be furnished one (1) complete set of reproducible mylar sepias (24 inches by 36 inches) and one (1) reproducible copy of the specifications.
 2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.
- C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, 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.
 2. 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.
- D. Specifications: The Technical Specifications consist of three (3) parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.
- E. Intent:
1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings 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 Drawings 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.
 2. 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, the interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

- A. Manufacturer:
1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option, 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.

2. Any two (2) or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.
2. 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:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind, or size of equipment, one (1) 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.
2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
3. 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 rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing 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.
2. 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:

1. 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. Five (5) 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.
2. 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 Documents, 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.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing 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:

1. All inspection and testing of materials furnished under this Contract will be provided by the Contractor, unless otherwise expressly specified.
2. 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.
3. 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 of materials and equipment which are rejected for non-compliance.

C. Certificate of Manufacture:

1. Contractor shall furnish to Engineer authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. 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.

D. Shop Tests:

1. 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.
2. Five (5) 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 and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

E. Start-up Tests:

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

F. Demonstration Tests:

1. Prior to Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.

2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests, at no additional cost to the Owner. Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish bench marks and baseline controlling points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall so place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions placed by him contrary to this provision.

B. Surveys:

1. The Contractor shall furnish and maintain, at his own expense, stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the reference marks set by the Engineer, and shall be solely responsible for the accuracy thereof. He shall, however, be subject to the check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, bear the cost of re-establishing 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.

2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if disturbed or destroyed.

END OF SECTION

SECTION 01010

SUMMARY OF PROJECT

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. This Contract is for the construction of the new South Columbia County Regional Wastewater Treatment Plant as shown on the Drawings and specified herein. The Work consists of furnishing all labor, equipment, and materials for the construction of the facilities consisting of, but not limited to, the following:
1. Construct one (1) headworks with the above-ground flow converging piping, flow measuring devices, mechanical and manual screens, and grit chamber.
 2. Construct one (1) two-unit, 0.16 million gallon per day (MGD) biological sequential batch reactor (SBR) system and all associated equipment.
 3. Construct one (1) SBR effluent equalization tank and the associated pump station for the treatment effluent.
 4. Construct two (2) automatic backwashing filters.
 5. Construct one (1) chlorine contact chamber.
 6. Construct one (1) chlorinated effluent wet well and the associated pump station.
 7. Construct one (1) 480,000-gallon concrete ground storage tank.
 8. Construct one (1) effluent pump station and flow monitoring facility.
 9. Construct one (1) spray irrigation system for effluent disposal.
 10. Construct one (1) pump station for activated sludge wasting.
 11. Construct one (1) aerobic sludge digester, furnish and install air piping, blowers, blower enclosures, diffusers, and sample collection sinks.
 12. Construct one (1) covered sludge drying bed.
 13. Install miscellaneous yard piping and electrical/instrumentation conduits and wiring.
 14. Install the process instrumentation and controls.
 15. Miscellaneous site work and stormwater system.
 16. Construct one (1) administration building and one (1) chlorination system building.
 17. Furnish laboratory equipment for the test lab.

1.02 PROJECT SEQUENCE

- A. The Contractor shall establish his work sequence based on the use of crews to facilitate completion of construction and testing within the specified Contract Time. The proposed project sequence, including Contractor's plans for provision of temporary facilities, shall be submitted to the Engineer prior to construction.

The general sequence of construction is governed by the regulatory constraints imposed on the facility.

END OF SECTION

SECTION 01027

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Submit Applications for Payment to the Engineer in accordance with schedule established by Conditions of the Contract and Agreement between Owner and Contractor. Contractor shall use the Application and Certificate for Payment Form included in Section 00844 as the official pay request form.
- B. Related Requirements Described Elsewhere:
 - 1. Agreement: Section 00500.
 - 2. Progress Payments, Retainages, and Final Payment: General Conditions: Section 00700 as amended by the Supplementary Conditions: Section 00800.
 - 3. Construction Progress Schedules: Section 01310.
 - 4. Schedule of Values: Section 01370
 - 5. Construction Photographs: Section 01380.
 - 6. Contract Closeout: Section 01700.
 - 7. Project Record Documents: Section 01720.

1.02 FORMAT REQUIRED

- A. Submit applications typed on the form provided in Division 0, Section 00844: Application and Certificate for Payment Form, with itemized data typed on 8-1/2 inch x 11 inch or white paper continuation sheets.
- B. Provide itemized data on continuation sheets of format, schedules, line items, and values specified on the Application and Certificate for Payment Form. The Contractor shall use the item descriptions and contract values included in schedule of values, approved and accepted by the Engineer as a basis for preparation of the Application for Payment Form.

1.03 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form:

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
2. Fill in percent complete for each activity and dollar values to agree with respective percents.
3. Execute certification with signature of a responsible officer of Contractor.

B. Continuation Sheets:

1. Fill in total list of all scheduled component items of the Work, with item number and scheduled dollar value for each item.
2. Fill in dollar value in each column for each scheduled line item when Work has been performed or products stored. Round off values to nearest dollar, or as specified for Schedule of Values.
3. List each Change Order executed prior to date of submission, at the end of the continuation sheets. List by Change Order Number, and description, as for an original component item of the Work.
4. To receive approval for payment on component material stored on site, submit copies of the original invoices with the Application and Certificate for Payment.
5. As provided for in the Application and Certificate for Payment Form, the Contractor shall certify, for each current pay request, that all previous progress payments received from the Owner, under this Contract, have been applied by the Contractor to discharge in full, all obligations of the Contractor in connection with Work covered by prior Applications for Payment, and all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest, and encumbrances. Contractor shall attach to each Application and Certificate for Payment like affidavits by all Subcontractors.

1.04 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. Contractor shall submit suitable information, with a cover letter identifying:

1. Project.
2. Application number and date.

3. Detailed list of enclosures.
4. For stored products:
 - a. Item number and identification as shown on application.
 - b. Description of specific material.
- B. Submit one (1) copy of data and cover letter for each copy of application.
- C. The Contractor is to maintain an updated set of drawings to be used as record drawings in accordance with Section 01720: Project Record Documents. As a prerequisite for monthly progress payments, the Contractor is to exhibit the updated record drawings for review by the Owner and the Engineer.
- D. Each monthly application for payment shall incorporate the corresponding "monthly progress status report" and updated construction schedule, prepared in accordance with the requirements of Section 01310: Construction Progress Schedules.
- E. As a prerequisite for payment, Contractor shall submit a duly executed letter from surety consenting to payment due and progress to date.
- F. Provide construction photographs in accordance with Section 01380: Construction Photographs.

1.05 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in application form as specified for progress payments. Provide information as required by the General Conditions and Section 01700: Contract Closeout.
- B. Furnish evidence of completed operations and insurance in accordance with the General Conditions.
- C. Provide Contractor's Final Release of Lien (Section 00849) and other close-out submittals as required by the General Conditions.

1.06 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to the Engineer between the first (1st) and the tenth (10th) day after the end of each calendar month for which payment is requested as stipulated in the Agreement. Review the percents complete with the Engineer and resolve any conflicts or discrepancies.

- B. Number of copies for each Application for Payment: Five (5) copies plus additional copies for Contractor's needs.
- C. When the Engineer finds the Application and Certificate for Payment Form is properly completed and correct, he will execute the Certificate for Payment and transmit the forms to the Owner, with a copy to the Contractor.

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 - GENERAL

1.01 PIPE LOCATIONS

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

1.02 OPEN EXCAVATIONS

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

1.03 TEST PITS

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

1.04 CARE AND PROTECTION OF PROPERTY

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

1.05 COOPERATION WITHIN THIS CONTRACT

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

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Provide and pay for field engineering service for Project.
 - 1. Survey work required in execution of Work.
 - 2. Civil, structural, or other professional engineering services specified or required to execute Contractor's construction methods.
 - 3. The method of field staking for the construction of the Work shall be at the option of the Contractor. The Owner has provided the engineering survey necessary to establish reference points which in his judgement are necessary to enable the Contractor to proceed with his work.
 - 4. The accuracy of any method of staking shall be the responsibility of the Contractor. All engineering for vertical and horizontal control shall be the responsibility of the Contractor.
 - 5. The Contractor shall be held responsible for the preservation of all stakes and marks. If any stakes or marks are carelessly or willfully disturbed by the Contractor, the Contractor shall not proceed with any work until he has established such points, marks, lines, and elevations as may be necessary for the prosecution of the Work.
 - 6. The Contractor shall retain the services of a registered land surveyor licensed in the State of Florida to identify existing control points and maintain a survey during construction.
- B. Related Requirements Described Elsewhere:
 - 1. Conditions of the Contract.
 - 2. Summary of Project: Section 01010.
 - 3. Project Record Documents: Section 01720.

1.02 QUALIFICATIONS OF SURVEYOR OR ENGINEER

- A. Qualified engineer or registered land surveyor, acceptable to the Owner and the Engineer.
- B. Registered professional engineer of the discipline required for the specific service on the Project, currently licensed in the State of Florida.

1.03 SURVEY REFERENCE POINTS

- A. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction.
 - 1. Make no changes or relocations without prior written notice to the Engineer.
 - 2. Report to the 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 at no additional cost to the Owner. Establish replacement based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of two (2) permanent benchmarks on site, referenced to data established by survey control points.
 - 1. Record locations, with horizontal and vertical data, on Project Record Documents.
- B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
 - 1. Site improvements:
 - a. Stakes for grading, fill, and topsoil replacement.
 - b. Utility slopes and invert elevations.
 - 2. Batter boards for structure.
 - 3. Building foundation, column locations, and floor levels.
 - 4. Controlling lines and levels required for mechanical and electrical trades.

- C. From time to time, verify layouts by same methods.

1.05 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. At the end of the project, submit a certified site survey at 1 inch equals 20 feet scale on reproducible tracing sheets 24 inches by 36 inches, indicating the new building corners and location of all new structures.
- C. At the end of the project, submit a certified survey at the same scale as the Engineer's line drawings indicating elevations and stationing at 100-foot pipe increments and at all valve and fitting locations.

1.06 SUBMITTALS

- A. Submit name and address of surveyor and professional engineer to the Engineer.
- B. On request of the Engineer, submit documentation to verify accuracy of field engineering work.
- C. Submit certificate signed by a registered engineer or surveyor certifying that elevations and locations of improvements are in conformance with the Contract Documents, or if not in conformance, certify as to variances from the Contract Documents.
- D. Submit drawings showing locations of all structures constructed. This drawing shall be included with the Project Record Documents.

END OF SECTION

SECTION 01065

PERMITS AND FEES

PART 1 - GENERAL

- A. The Contractor shall secure and pay for all permits and licenses related to his work, including but not limited to, necessary construction permits as provided for in Section 00700: General Conditions except as otherwise provided herein.
- B. Permits by Owner: The Owner prior to the advertisement of the project has applied for permits with the following agencies:
 - 1. FDEP Wastewater Treatment Plant Construction permit No. FLA632759.
 - 2. FDEP Environmental Resource General Permit Notification No. 12-293596-001-EG.
 - 3. NPDES Permit and Compliance.

END OF SECTION

SECTION 01070

ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 STANDARDS AND ABBREVIATIONS

- A. Referenced Standards: Any reference to published specifications or standards of any organization or association shall comply with the requirements of the specification or standard which is current on the date of Advertisement for Bids. In case of a conflict between the referenced specifications or standards, the one having the more stringent requirements shall govern.

In case of conflict between the referenced specifications or standards and the Contract Documents, the Contract Documents shall govern.

- B. Abbreviations:

AA	Aluminum Association
AAA	American Arbitration Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AASHO	The American Association of State Highway Officials
ABA	American Bar Association
ABMA	American Boiler Manufacturers Association
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIA	American Insurance Association
AIEE	American Institute of Electrical Engineers (Now IEEE)
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Condition Association
ANSI	American National Standard Institute

APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ARI	American Refrigeration Institute
ASA	American Standards Association (Now ANSI)
ASAHBC	American Society of Architectural Hardware Consultants
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASSHTO	American Association of State Highway Transportation Officials
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America (formerly SCPI)
CDA	Copper Development Association
CFS	Cubic Feet Per Second
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DOT Spec	Standard Specification for Road and Bridge Construction Florida Department of Transportation, 1982
E/A	Engineer and/or Architect
EDA	Economic Development Association
EEI	Edison Electric Institute
EPA	Environmental Protection Agency
FCI	Fluid Control Institute
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
Fed Spec	Federal Specification
FPS	Feet Per Second
FS	Federal Standards
GPM	Gallons Per Minute
HMI	Hoist Manufacturers Institute
HP	Horsepower
HSBII	Hartford Steam Boiler Inspection and Insurance Co.

ID	Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IFI	Industrial Fasteners Institute
IPCEA	Insulated Power Cable Engineers Association
IPS	Iron Pipe Size
MGD	Million Gallons Per Day
MHI	Materials Handling Institute
MMA	Monorail Manufacturers Association
NBFU	National Board of Fire Underwriters
NBHA	National Builders' Hardware Association
NBS	National Bureau of Standards
NCSA	National Crushed Stone Association
NCSPA	National Corrugated Steel Pipe Association
NEC	National Electrical Code
NECA	National Electrical Contractors' Association
NEMA	National Electrical Manufacturers' Association
NFPA	National Fire Protection Association
NLA	National Lime Association
NPC	National Plumbing Code
NPT	National Pipe Threads
NSC	National Safety Council
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	U.S. Department of Labor, Occupational Safety and Health Act
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
PSI	Pounds per Square Inch
PSIA	Pounds per Square Inch Absolute
PSIG	Pounds per Square Inch Gauge
RAS	Return Activated Sludge
RPM	Revolutions Per Minute
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SFWMD	South Florida Water Management District
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SSI	Scaffolding and Shoring Institute
SSPC	Steel Structures Painting Council
SSPC	Structural Steel Painting Council
STA	Station (100 feet)
TDH	Total Dynamic Head
TH	Total Head
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.

USASI or	United States of America Standards Institute
WAS	Waste Activated Sludge

- C. Additional abbreviations and symbols are shown on the Drawings.

END OF SECTION

SECTION 01091

REFERENCE SPECIFICATIONS

PART 1 - GENERAL

1.01 GENERAL

- A. Applicable Publications. Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of or omission from said standards or requirements.
- B. Assignment of Specialists. In certain instances, specification test requires (or implies) that specific work is to be assigned to specialist or expert entities who must be engaged for the performance of the Work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. They are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of such referenced documents which are not in conflict with the requirements of these Specifications or applicable codes.
- B. References herein to "Building Code" shall mean the Southern Standard Building Code (SSBC) of the Southern Building Code Congress (SBCC). The latest edition of the code as approved and used by the local agency as of the date of award as adopted by the agency having jurisdiction shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

- C. In case of conflict between codes, reference standards, Drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.
- D. Applicable Standard Specifications. The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed.

END OF SECTION

SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.01 PUBLIC NUISANCE

- A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.
- B. Sound levels measured by the Engineer shall not exceed 50 dBA from 7 P.M. to 7 A.M. or 60 dBA 7 A.M. to 7 P.M. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or Owner for excessive noise shall not relieve the Contractor of the other portions of this Specification including, but not limited to, completion dates and bid amounts.
- C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.02 HAULING AND CONSTRUCTION OPERATIONS ON PLANT PROPERTY

- A. The Contractor shall conduct access, hauling, filling, and storage operations as specified herein and as shown on the Contract Drawings.
 - 1. On-site borrow areas are designated as follows: None, all borrow material required shall be provided by the Contractor from off-site.
 - 2. On-site spoil areas will become property of the Contractor and removed from the site.
 - 3. The County shall work with the Contractor to allow extended hours for large concrete and fill operations. A minimum of 72 hours advanced written notice shall be required for the Contractor to obtain approval from the County to work extended hours.
- B. Construct all fill areas so runoff will not flood improved areas.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall cooperate and coordinate with the Engineer to schedule and administer the pre-construction meeting, periodic progress meetings, and specifically called meetings throughout the progress of the Work. The Contractor shall:
 - a. Prepare agenda for meetings.
 - b. Make physical arrangements for meetings.
 - c. Preside at meetings.
 - d. Take and distribute meeting minutes.
2. Representatives of Contractor, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
3. The Owner shall attend meetings to ascertain that the Work is expedited consistent with Contract Documents and construction schedules.
4. The Contractor shall record the pre-construction meeting and each progress meeting in its entirety, and shall provide the Engineer with a regular cassette copy of such recording, having good quality and clarity, and a typed transcript of the minutes of each meeting. A copy of the minutes of each progress meeting shall be available five business days after the meeting.

B. Related Requirements Described Elsewhere:

1. Construction Progress Schedules: Section 01310.
2. Shop Drawings, Working Drawings, and Samples: Section 01340.
3. Project Record Documents: Section 01720.

1.02 PRE-CONSTRUCTION MEETING

- A. Engineer will schedule a pre-construction meeting no later than twenty (20) days after date of Notice to Proceed. The meeting shall be scheduled at the convenience of all parties.
- B. Location: A local site, convenient for all parties, designated by the Engineer.
- C. Attendance:
 - 1. Owner's representative.
 - 2. Engineer and his professional consultants.
 - 3. Resident project representative.
 - 4. Contractor and his superintendent.
 - 5. Major subcontractors.
 - 6. Representatives of major suppliers and manufacturers as appropriate.
 - 7. Governmental representatives as appropriate.
 - 8. Others as requested by the Contractor, Owner, and Engineer.
- D. The Engineer shall preside at the pre-construction meeting. The Contractor shall provide for keeping minutes and distribution of minutes to the Owner, Engineer and others. The purpose of the pre-construction meeting is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established.
- E. The suggested agenda for the pre-construction meeting would include the following:
 - 1. Distribution and discussion of:
 - a. List of major subcontractors and suppliers.
 - b. Projected schedules.
 - c. Schedule of Values.
 - 2. Critical work sequencing: Relationships and coordination with other contracts and/or work.

3. Major equipment deliveries and priorities.
4. Project coordination: Designation and responsible personnel.
5. Procedures and processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Request for Information.
 - d. Submittals.
 - e. Change Orders.
 - f. Applications for Payment.
6. Submittal of Shop Drawings, project data and samples.
7. Adequacy of distribution of Contract Documents.
8. Procedures for maintaining Record Documents
9. Use of premises:
 - a. Office, work, and storage areas.
 - b. Owner's requirements.
 - c. Access and traffic control.
10. Construction facilities, controls, and construction aids.
11. Temporary utilities.
12. Safety and first aid procedures.
13. Check of required Bond and Insurance certifications.
14. Completion time for contract and liquidated damages.
15. Request for extension of Contract Time.

16. Procedures for periodic monthly (or whatever interval is deemed appropriate or necessary, however, a minimum of monthly meetings will be required) progress meetings, for all involved.
17. Security procedures.
18. Procedures for making partial payments.
19. Guarantees on completed work.
20. Equipment to be used.
21. Project layout and staking of work.
22. Project inspection.
23. Labor requirements.
24. Laboratory testing of material requirements.
25. Provisions for material stored on-site and monthly inventory of materials stored.
26. Requirements of other organizations such as utilities, railroads, highway departments, building departments.
27. Rights-of-way and easements.
28. Housekeeping procedures.
29. Liquidated damages.
30. Posting of signs and installation of Project Sign.
31. Pay request submittal dates.
32. Equal opportunity requirements.

1.03 PROGRESS MEETINGS

- A. The Engineer shall schedule regular periodic meetings. The progress meetings will be held a minimum of once every thirty (30) days and at other times as required by the progress of the Work. The first meeting shall be held within thirty (30) days after the pre-construction meeting or thirty (30) days or less after the date of Notice to Proceed.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the meetings: Owner/Engineer's Field Office (See Section 01500, Paragraph 2.05).
- D. Attendance:
 - 1. Engineer and his professional Subconsultants as needed.
 - 2. Resident Project Representative.
 - 3. Contractor and his Superintendent.
 - 4. Owner's representatives.
 - 5. Subcontractors (active on the site, as appropriate to the agenda).
 - 6. Others as appropriate to the agenda (suppliers, manufacturers, other subcontractors, etc.).
- E. The Contractor shall preside at the meetings and provide for keeping minutes and distribution of the minutes to the Owner, Engineer, and others. The purpose of the meetings will be to review the progress of the Work.
- F. The suggested agenda for the progress meetings will include but not be limited to the following:
 - 1. Review approval of minutes of previous meeting.
 - 2. Review of Work progress since previous meeting and Work scheduled (3-week look ahead schedule).
 - 3. Field observations, problems, conflicts.
 - 4. Problems which impede construction schedule.
 - 5. Review of off-site fabrication, delivery schedules.

6. Corrective measures and procedures to regain projected schedule.
 7. Status of approved Construction Schedule and revisions to the Construction Schedule as appropriate.
 8. Progress schedule during succeeding work period.
 9. Coordination of schedules.
 10. Review status of submittals and submittal schedule, expedite as required.
 11. Maintenance of quality standards.
 12. Pending changes and substitutions.
 13. Shop drawing problems.
 14. Review proposed changes for:
 - a. Effect on Construction Schedule and on completion date.
 - b. Effect on other contracts of the Project.
 15. Critical/long lead items.
 16. Other business.
- G. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, and be prepared to discuss pertinent topics and provide specific information including but not limited to:
1. Status of all submittals and what specifically is being done to expedite them.
 2. Status of all activities behind schedule and what specifically will be done to regain the schedule.
 3. Status of all material deliveries, latest contact with equipment manufacturer, and specific actions taken to expedite materials.
 4. Status of open deficiencies and what is being done to correct the same.
- H. The Contractor is to provide a current submittal log at each progress meeting in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.

END OF SECTION

SECTION 01310

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Promptly after award of the Contract, prepare and submit to the Engineer estimated construction progress schedules demonstrating complete fulfillment of all Contract requirements utilizing a Critical Path Method (hereinafter referred to as CPM) in planning, coordinating, and performing the Work under this Contract (including all activities of subcontractors, equipment vendors, and suppliers). The principles and definition of CPM terms used herein shall be as set forth in the Associated General Contractors of America (AGC) publication, Construction Planning & Scheduling Manual, Copyright 1984, but the provisions of this Specification shall govern the planning, coordinating, and performance of the Work.
2. Submit revised progress schedules on a monthly basis. No partial payments shall be approved until there is an approved construction progress schedule on hand.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.
2. Summary of Project: Section 01010.
3. Project Meetings: Section 01200.
4. Applications for Payment: Section 01027
5. Shop Drawings, Working Drawings, and Samples: Section 01340.
6. Schedule of Values: Section 01370

1.02 QUALIFICATIONS

- A. A statement of computerized CPM capability shall be submitted in writing prior to the award of the Contract and shall verify that either Contractor's organization has in-house capability to use the CPM technique or that Contractor will employ a CPM consultant who is so qualified.
- B. In-house capability shall be verified by description of construction projects to which Contractor or Contractor's consultant has successfully applied computerized CPM and shall include at least two (2) projects valued at least half the expected value of this project.

1.03 FORM OF SCHEDULES

- A. Prepare schedules in the form of a horizontal bar chart.
 - 1. Provide a separate horizontal bar for each trade or operation within each structure or item.
 - 2. Horizontal time scale:
 - a. Show starting and completion dates for each activity in terms of the number of days after Notice to Proceed. All completion dates shown shall be within the period specified for contract completion.
 - b. Identify the first work day of each month.
 - 3. Scale and Spacing: Sufficient to allow space for notations and future revisions.
 - 4. Maximum Sheet Size: 24-inches by 36-inches.
- B. Format of Listings: The chronological order of the start of each item of work for each structure.
- C. Identification of Listings: By major specification section numbers as applicable and by structure.
- D. Construction Progress Schedules shall be computer generated using software equal to Primavera Project Planner for Windows by Primavera Systems, Inc., Microsoft Project, or approved equal.

1.04 CONTENT OF SCHEDULES

A. Construction Progress Schedule:

1. Show the complete sequence of construction by activity and by structure.
2. Show the dates for the beginning and completion of each major element of construction in no more than a two (2) week increment scale. Specifically list, but do not limit to:
 - a. Shop Drawing Schedule.
 - b. Installation of temporary facilities.
 - c. Site clearing.
 - d. Site utilities.
 - e. Foundation work.
 - f. Structural framing.
 - g. Subcontractor work.
 - h. Equipment installations.
 - i. Finishings.
 - j. Instrumentation.
 - k. Electrical.
 - l. Painting.
 - m. Operator training and receipt of operation and maintenance manuals.
 - n. Equipment Testing.
 - o. Equipment and process start-up.
 - p. Receipt of spare parts.
 - q. Project closeout.

3. Show projected percentage of completion for each item, as of the first day of each month.
 4. Show projected dollar cash flow requirements for each month of construction and for each activity as indicated by the approved Schedule of Values.
- B. Submittals for construction progress schedules shall be in accordance with Section 01340: Shop Drawings, Work Drawings, and Samples. Indicate on the schedule the following:
1. The dates for Contractor's submittals.
 2. The dates submittals will be required for Owner-furnished products, if applicable.
 3. The dates approved submittals will be required from the Engineer.
- C. A typewritten list of all long lead items (equipment, materials, etc.).
- D. To the extent that the progress schedule or any revised progress schedule shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Engineer. Failure to include any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the Engineer's approval of the progress schedule.
- E. Scheduling Constraints: The work within Owner's property must be completed within the maximum number of days start to finish, as indicated in the Contract. Additionally, work must proceed on a continuous basis, without stoppages, except for nights and weekends. There shall be no lapses between phases of construction.

1.05 PROGRESS REVISIONS

- A. Indicate progress of each activity to date of submission.
- B. Show changes occurring since previous submission of schedule:
1. Major changes in scope.
 2. Activities modified since previous submission.
 3. Revised projections of progress and completion.

4. Other identifiable changes.
- C. Provide a narrative report as needed to define:
1. Problem areas, anticipated delays, and the impact on the schedule.
 2. Corrective action recommended, and its effect.
 3. The effect of changes on schedules of other prime contractors.
- D. If the Work falls behind the critical path schedule by two (2) weeks or more, the Contractor shall prepare a recovery schedule.

1.06 SUBMISSIONS

- A. Submittal Requirements.
1. Logic network and/or time-phased bar chart, computer generated.
 2. Computerized network analysis:
 - a. Sort by early start
 - b. Sort by float
 - c. Sort by predecessor/successor
 3. Narrative description of the logic and reasoning of the schedule.

B. Time of Submittals.

Within ten (10) working days after Notice to Proceed, Contractor shall submit a network diagram describing the activities to be accomplished in the project and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The total length of time indicated on the initial CPM schedule shall equal the exact number of days in the Contract Time as defined in Section 00500: Agreement. The schedule produced and submitted shall also indicate calendar dates, including project starting and completion dates, based on the Contract Commencement and completion dates indicated in the Notice to Proceed. The Engineer will complete the review of the complete schedule within fifteen (15) working days after receipt. During the review process, the Engineer may meet with a representative of Contractor to review the proposed plan and schedule to discuss any clarifications that may be necessary.

- C. Within ten (10) working days after the conclusion of the Engineer's review period, Contractor shall revise the network diagram as required and resubmit the

network diagram and a tabulated schedule produced therefrom. The revised network diagram and tabulated schedule shall be reviewed and accepted or rejected by the Engineer within fifteen (15) working days after receipt. The network diagram and tabulated schedule, when accepted by the Engineer, shall constitute the project work schedule unless a revised schedule is required due to substantial changes in the Work, a change in Contract Time or a recovery schedule is required and requested.

- D. Acceptance. The finalized schedule will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates an orderly progression of the Work to completion in accordance with the Contract Documents. Such acceptance will neither impose on the Engineer responsibility for the progress or scheduling of the Work nor relieve Contractor from full responsibility therefore. The finalized schedule of shop drawing submittals will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates a workable arrangement for processing the submittals in accordance with the requirements. The finalized Schedule of Values (lump sum price breakdown), as applicable, will be acceptable to the Engineer as to form and content when, in the opinion of the Engineer, it demonstrates a substantial basis for equitably distributing the Contract Price. When the network diagram and tabulated schedule have been accepted, the Contractor shall submit to the Engineer six (6) copies of the time-scaled network diagram, six (6) copies of a computerized tabulated schedule in which the activities have been sequenced by numbers, six (6) copies of a computerized tabulated schedule in which the activities have been sequenced by early starting date, and six (6) copies of a computerized, tabulated schedule in which activities have been sequenced by total float, and six (6) copies sorted by predecessor/successor.
- E. Revised Work Schedules. Contractor, if requested by the Engineer, shall provide a revised work schedule if, at any time, the Engineer considers the completion date to be in jeopardy because of "activities behind schedule." The revised work schedule shall include a new diagram and tabulated schedule conforming to the requirements of Paragraph 1.09 herein, designed to show how Contractor intends to accomplish the Work to meet the completion date. The form and method employed by Contractor shall be the same as for the original work schedule. No payment will be made if activities fall more than two (2) weeks behind schedule and a revised work schedule is not furnished.
- F. Schedule Revisions. The Engineer may require Contractor to modify any portions of the work schedule that become infeasible because of "activities behind schedule" or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration, or relationships of any activity without approval of the Engineer.

1.07 DISTRIBUTION

- A. Distribute copies of the reviewed schedules to:
 - 1. Engineer.
 - 2. Jobsite file.
 - 3. Subcontractors.
 - 4. Other concerned parties.
 - 5. Owner (two copies).
- B. Instruct recipients to report promptly to the Contractor, in writing, any problems anticipated by the projections shown in the schedules.

1.08 CHANGE ORDERS

- A. Upon approval of a change order, the approved changes shall be reflected in the next scheduled revision or update submittal of the construction progress schedule by the Contractor.

1.09 CPM STANDARDS

- A. CPM, as required by this Section, shall be interpreted to be generally as outlined in the Associated General Contractor's (AGC) publication, Construction Planning & Scheduling Manual, Copyright 1984.
- B. Work schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:
 - 1. A logical succession of work from start to finish.
 - 2. Definition of each activity. Activities shall be identified by major specification section numbers, as applicable, and by major structure.

3. A logical flow of work crews/equipment (crews are to be defined by manpower category and man-hours; equipment by type and hours).
4. Show all work activities and interfaces including submittals as well as major material and equipment deliveries.

C. Networks.

1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Notation on each activity line shall include a brief work description and a duration as described in Paragraph 1.09, D. herein.
2. All construction activities and procurement shall be indicated in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical path activities, and float for each non-critical activity. All non-critical path activities shall show estimated performances time and float time in scaled form.

D. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the work and resources planned for the activity including time for inclement weather. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed fourteen (14) days nor be less than one (1) day unless otherwise accepted by the Engineer.

E. Tabulated Schedules. The initial schedule shall include the following minimum data for each activity.

1. Activity Beginning and Ending Numbers (i-j numbers) (single activity numbers may be used).
2. Duration.
3. Activity Description.
4. Early Start Date (Calendar Dated).
5. Late Start Date (Calendar Dated).

6. Early Finish Date (Calendar Dated).
 7. Late Finish Date (Calendar Dated).
 8. Identified Critical Path.
 9. Total Float (Note: No activity may show more than 20 days float).
 10. Cost of Activity.
 11. Equipment Hours, by type; Man-Power Hours, by crew or trade.
- F. Project Information. Each tabulation shall be prefaced with the following summary data.
1. Project Name.
 2. Contractor.
 3. Type of Tabulation (Initial or Updated).
 4. Project Duration.
 5. Project Scheduled Completion Date.
 6. Effective or Starting Date of the Schedule.
 7. New Project Completion Date and Project Status (if an updated or revised schedule).
 8. Actual Start Date and Actual Finish Date (for all updated schedules.)

1.10 SCHEDULE MONITORING

- A. At not less than monthly intervals or when specifically requested by Engineer, Contractor shall submit to the Engineer a computer printout of an updated schedule for those activities that remain to be completed. Typically, the updated schedule will be submitted with the application for payment as specified below.
- B. The updated schedule shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

1.11 PROGRESS MEETINGS

For the monthly progress meeting, Contractor shall submit a revised CPM schedule and a 3-week look-ahead schedule, showing all activities completed, in progress, uncompleted,

or scheduled to be worked during the weeks. The 3-weeks include the current week plus the next 2-weeks. All activities shall be from the approved CPM and must be as shown on the CPM unless behind or ahead of schedule. One (1) copy of the revised CPM schedule shall be submitted with each copy of that month's application for payment, six (6) copies minimum.

END OF SECTION

SECTION 01340

SHOP DRAWINGS, WORKING DRAWINGS, AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Contractor shall submit to the Engineer for review and approval, such Shop Drawings, Test Reports, and Product 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 Shop Drawings, Data, and Samples for materials and equipment specified elsewhere in the Specifications and in the Drawings.
2. Within fourteen (14) calendar days after the Notice to Proceed, 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. Review of this list by the Engineer shall in no way expressed or implied relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Contract Documents. This procedure is required in order to expedite final review of Shop Drawings.
3. 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:
 - a. Submittal description and number assigned.
 - b. Date to Engineer.
 - c. Date returned to Contractor (from Engineer).
 - d. Status of submittal (Approved, Approved as Noted, Amend and Resubmit, and Rejected).
 - e. Date of resubmittal and return (as applicable).
 - f. Date material release (for fabrication).

- g. Projected date of fabrication.
- h. Projected date of delivery to site.
- i. Status of O&M manuals submittal.
- j. Specification Section.
- k. Drawings sheet number.

B. Related Requirements Described Elsewhere:

- 1. General Conditions: Section 00700.
- 2. Shop Drawing Submittal Form: Section 00847.
- 3. Construction Progress Schedules: Section 01310.
- 4. Material and Equipment: Section 01600.
- 5. Project Record Documents: Section 01720.
- 6. Operating and Maintenance Data: Section 01730.

1.02 CONTRACTOR'S RESPONSIBILITY

A. It is the responsibility of the Contractor to check all drawings, data and samples prepared before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear the 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. If the Contractor takes exception to the specifications, the Contractor shall note the exception in the letter of transmittal to the Engineer.

B. Determine and verify:

- 1. Field measurements.
- 2. Field construction criteria
- 3. Catalog numbers and similar data.
- 4. Conformance with 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 and ending 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 Shop 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 approval.
- E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than thirty (30) calendar days for checking and appropriate action from the time the Engineer receives them.
- F. All submittals shall be accompanied with a transmittal letter prepared in duplicate containing the following information:
 - 1. Date.
 - 2. Project Title and Number.
 - 3. Contractor's name and address.
 - 4. The number of each Shop Drawings, Project Data, and Sample submitted.
 - 5. Notification of Deviations from Contract Documents.
 - a. The Contractor shall indicate in **bold type** at the top of the cover sheet of submittal of shop drawing if there is a deviation from the Drawings, Specifications, or referenced specifications or codes.
 - b. The Contractor shall also list any deviations from the Drawings, Specifications, or referenced specifications or codes and identify in green ink prominently on the applicable Shop Drawings.
 - 6. Submittal Log Number conforming to Specification Section Number.
- G. The Contractor shall submit five (5) copies of descriptive or product data information and Shop Drawings to the Engineer plus the number of copies which the Contractor requires returned. The Engineer will review the Drawings and return to the Contractor the marked-up copies with appropriate review comments.
- H. The Contractor shall be responsible for and bear all costs 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 the Engineer of the necessary Shop Drawings.

- I. The Contractor shall be fully responsible for observing the need for and making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the materials/equipment he proposes to supply both as pertains to his own work and any work affected under other parts, headings, or divisions of the Drawings and Specifications.
- J. The Contractor shall not use Shop Drawings as a means of proposing alternate items to demonstrate compliance with the Drawings and Specifications.
- K. Each submittal will bear a stamp indicating that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal as illustrated below.

(OWNER'S NAME)	
(PROJECT NAME)	
(PROJECT NUMBER)	
SHOP DRAWING NO.: _____	
SPECIFICATION SECTION: _____	DRAWING NO. _____
WITH RESPECT TO THIS SHOP DRAWING OR SAMPLE, I HAVE DETERMINED AND VERIFIED ALL QUANTITIES, DIMENSIONS, SPECIFIED PERFORMANCE CRITERIA, INSTALLATION REQUIREMENTS, MATERIALS, CATALOG NUMBERS, AND SIMILAR DATA WITH RESPECT THERETO AND REVIEWED OR COORDINATED THIS SHOP DRAWING OR SAMPLE WITH OTHER SHOP DRAWINGS AND SAMPLES AND WITH THE REQUIREMENTS OF THE WORK AND THE CONTRACT DOCUMENTS.	
_____ NO VARIATION FROM CONTRACT DOCUMENTS	
_____ VARIATION FROM CONTRACT DOCUMENTS AS SHOWN	
(CONTRACTOR'S NAME)	
(CONTRACTOR'S ADDRESS)	
BY: _____	DATE: _____
AUTHORIZED SIGNATURE	

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

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS

- A. The Engineer's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(s) generally conforms to the information in the Contract Documents and is compatible with the design concept. The Engineer's review and exceptions, if any, will not constitute an approval of dimensions, connections, quantities, and details of the material, equipment, device, or item shown.
- B. The review of drawings and schedules will be general, and shall not be construed:
 - 1. As permitting any departure from the Contract Documents.
 - 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 Documents 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 contract time, the Engineer may return the reviewed drawings without noting an exception.
- D. "Approved As Noted" - Contractor shall incorporate Engineer's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the Engineer acknowledging the comments and their incorporation into the Shop Drawing.
- E. "Amend And Resubmit" - Contractor shall resubmit the Shop Drawing to the Engineer. The resubmittal shall incorporate the Engineer's comments highlighted on the Shop Drawing.
- F. "Rejected" - Contractor shall correct, revise and resubmit Shop Drawing for review by Engineer.
- G. 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.
- H. If the Contractor considers any correction indicated on the drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

- I. When the Shop Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.
 - J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the Engineer, make all submittals in groups containing all associated items for:
 - 1. Systems.
 - 2. Processes.
 - 3. As indicated in specific Specifications Sections.
- All drawings, schematics, manufacturer's product Data, certifications, and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interface review.
- K. Only the Engineer shall utilize the color "red" in marking Shop Drawing submittals.
 - L. Shop drawing and submittal data shall be reviewed by the Engineer for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor and the Contractor shall reimburse the Owner for services rendered by the Engineer as specified in the Supplementary Conditions.

1.04 SHOP DRAWINGS

- A. When used in the Contract Documents, the term "Shop Drawing" shall be considered to mean Contractor's plans for materials and equipment which become an integral part of the Project. Shop Drawings shall be complete and detailed and shall consist of fabrication, erection, setting and schedule drawings, manufacturer's scale drawings, and wiring and control diagrams. Catalogs cuts, catalogs, pamphlets, descriptive literature, and performance and test data shall be considered only as supportive information to required Shop Drawings as defined above. As used herein, the term "manufactured" applies to standard units usually mass-produced; and "fabricated" means items specifically assembled or made out of selected materials to meet individual design requirements.
- B. Manufacturer's catalog sheets, brochures, diagrams, illustrations, and other standard descriptive data shall be clearly marked to identify pertinent materials, products, or models. Delete information which is not applicable to the Work by striking or cross-hatching.

- C. Each Shop Drawing shall be submitted with an 8-1/2" by 11" cover sheet which shall include a title block for the submittal. Each Shop Drawing cover sheet shall have a blank area 3-1/2 inches high by 4-1/2 inches wide, located adjacent to the title block. The title block/cover sheet shall display the following:
1. Project Title and Number.
 2. Name of project building or structure.
 3. Number and title of the Shop Drawing.
 4. Date of Shop Drawing or revision.
 5. Name of Contractor and subcontractor submitting drawing.
 6. Supplier/manufacturer.
 7. Separate detailer when pertinent.
 8. Specification title and Section number.
 9. Applicable Drawing number.
- D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, catalog cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, 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.
- E. 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.
- F. 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 for executing the Work in accordance with the Contract, even though such drawings have been reviewed.
- G. All manufacturers or equipment suppliers who propose 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 (5) installations where identical equipment has been installed and has been in operation for a period of at least two (2) years unless specified otherwise in the Specification Section applicable.

1.05 WORKING DRAWINGS

- A. When used in the Contract Documents, the term "Working Drawings" shall be considered to mean the Contractor's plan for temporary structures such as temporary bulkheads, support of open cut excavation, support of utilities, ground water control systems, forming and falsework for underpinning, and for such other work as may be required for construction but does not become an integral part of the Project.
- B. Copies of working drawings as noted in paragraph 1.05 A. 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) calendar days (unless otherwise specified by the Engineer) in advance of their being required for the 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 to new or existing work are assumed by the Contractor; the Owner and Engineer shall have no responsibility therefor.

1.06 SAMPLES

- A. The Contractor shall furnish, for the approval of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved 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 three (3) samples of each item shall be submitted.
- C. Each sample shall have a label indicating:
1. Name of Project.
 2. Name of Contractor and subcontractor.
 3. Material or equipment represented.
 4. Place of origin.
 5. Name of producer/supplier and brand (if any).
 6. Location in Project.
 7. Submittal and specification numbers.
- (Samples of finished materials shall have additional marking that will identify them under the finished schedules.)
- D. The Contractor shall prepare a transmittal letter and a description sheet for each shipment of samples. The description sheet shall contain the information required in Paragraphs 1.06B and C above. He shall enclose a copy of the letter and description sheet with the shipment and send a copy of the letter and description sheet to the Engineer. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.
- E. Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the Work. Approved Samples of the hardware in good condition will be marked for identification and may be used in the Work. Materials and equipment incorporated in the Work shall match the approved Samples. Samples which failed testing or were not approved will be returned to the Contractor at his expense, if so requested at time of submission.

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Submit to the Engineer a Schedule of Values allocated to the various lump sum portions of the Work, at the Pre-Construction Conference, and as otherwise specified or requested to be submitted earlier as evidence of the Apparent Low Bidder's qualifications.
2. Upon request of the Engineer support the values with data which will substantiate their correctness. The data shall include, but not be limited to quantity of materials, all sub-elements of the activity, and their units of measure.
3. The Schedule of Values shall establish the actual value for each activity of the Work to be completed taken from the approved Critical Path Method (CPM) Construction Schedule, and shall be used as the basis for the Contractor's Applications for Payment.

B. Related Requirements Described Elsewhere:

1. Conditions of the Construction Contract.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on 8-1/2 inch x 11 inch white paper. Contractor's standard forms and computer printouts may be considered for approval by the Engineer upon Contractor's request. Identify schedule with:

1. Title of project and location.
2. Owner and purchase order number.
3. Engineer and project number.
4. Name and address of Contractor.

5. Contract designation.
 6. Date of submission.
- B. Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing item prices for progress payments during construction.
 - C. Identify each line item with the number and the title of the respective section of the Specifications.
 - D. For each major item of the Work, list sub-values of major products or operations under the major item.
 - E. For the various portions of the Work:
 1. The amount for each item shall reflect a total installed cost including a directly proportional amount of the Contractor's overhead and profit.
 2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials. Payment for materials shall be limited to the invoiced amount only.
 - b. The total installed value.
 - F. Round off figures to nearest dollar amount.
 - G. The sum of the costs of all items listed in the schedule shall equal the total Contract Price.
 - H. For each item which has an installed value of more than \$15,000, provide a breakdown of costs to list major products or operations under each item.
 - I. The form of the Schedule of Values shall parallel the form presented in Section 00845, Schedule of Values Form. As a minimum, the Contractor shall provide a contract value for all of the items listed in Table 01370-1. The Contractor may add additional items for convenience of pay request approvals.

1.03 SUB-SCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a separate schedule of unit prices for materials to be stored on site and for those materials incorporated into the Work for which progress payments will be requested.
- B. Format shall parallel that shown in Section 00846: Materials Stored On Site Form and Section 00845: Schedule of Values Form.
- C. The unit values for the materials shall be broken down into:
 - 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 - 2. Copies of paid invoices for component material shall be included with the payment request in which the material first appears.
- D. Only materials unique to the project may be billed when stored on site. Materials of standard use such as conduit, wire, small-diameter pipe, steel, etc., shall not be accepted for payment.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

1.04 REVIEW AND RESUBMITTAL

- A. After review by Engineer, revise and resubmit Schedule of Values and Schedule of Unit Material Values as required.
- B. Resubmit revised schedules in same manner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

TABLE 01370-1

SAMPLE SCHEDULE OF VALUES

- I. General Requirements
 - Indemnification
 - Mobilization/Demobilization (per Specification Section 01505 - Mobilization, Payment for this item shall not exceed 3-percent of the total contract price)
 - Plant/Process Start-up
 - Testing

- II. Sitework
 - Clearing and Grubbing
 - Excavation
 - Embankment
 - Grading (Finish)
 - Retention Ponds
 - Fencing
 - Seeding & Mulching
 - Sodding
 - Sidewalk
 - Erosion Protection
 - Conduit & Fittings
 - Wire
 - Lighting
 - Wiring Devices, Starters
 - Wire Terminations
 - Manholes
 - Walkways

- III. Yard Piping, Valves & Fittings
 - Piping itemized per size and material
 - Valves itemized per size and type
 - Fittings itemized per size and type
 - Manholes

- IV. SBR Basin
 - Excavation
 - Backfill & Compaction
 - Foundation Concrete
 - Concrete Walls
 - Concrete Columns
 - Concrete Beams
 - Fill Concrete
 - Elevated Slab
 - Pre-stressed Concrete
 - Pre-cast Concrete

- Water Stop
- Grating
- Pipe, Valves and Fittings
- Aluminum Handrails
- Miscellaneous Metals
- Painting
- MLE/Process Equipment
- Stairs
- Conduit & Fittings
- Wire
- Lighting
- Wiring Devices, Starters
- Disconnect Switches
- Wire Terminations
- Variable Frequency Drives

V. Ground Storage Tank, Digester

- Excavation
- Backfill & Compaction
- Prestressed Concrete Tank
- Piping, Valves, and Fittings
- Miscellaneous Metals
- Painting
- Clarifier Equipment
- Conduit & Fittings
- Wire
- Lighting
- Wiring Devices, Starters
- Disconnect Switches
- Wire Terminations

VI. Pumping Stations, Filtration Equipment

- Excavation
- Backfill & Compaction
- Slab on Grade
- Piping, Valves, and Fittings
- Horizontal Non-Clog Centrifugal Pumps
- Vertical Non-Clog Centrifugal Pumps
- Conduit & Fittings
- Wire
- Lighting
- Wiring Devices, Starters
- Disconnect Switches
- Wire Terminations
- Variable Frequency Drives

VII. Chlorine Contact Chamber

- Concrete Walls
- Piping, Valves, and Fittings
- Grating
- Aluminum Handrails
- Miscellaneous Metals
- Painting
- Slide/Weir Gates
- Conduit & Fittings
- Wire
- Lighting
- Wiring Devices, Starters
- Disconnect Switches
- Wire Terminations

VIII. Effluent Pump Station

- Excavation
- Backfill & Compaction
- Concrete Wetwell and Valve Vault
- Piping, Valves, and Fittings
- In-Plant Pump Station Pump & Internals
- Coatings

IX. Control Systems, Buildings

- Digitally Based Monitoring & Control
- Computers, Printers
- Console
- PLC, Remote I/O
- Cabling
- Programming
- Field Instruments
- Field Panels
- Documentation
- Testing
- Masonry Block
- Slab on Grade
- Roofs, Windows, Doors
- Interior Fixtures
- Exterior Fixtures
- Blower Equipment
- Chlorine Tanks
- Chlorine Pumps and Equipment

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Scope of Work: The Contractor shall employ a competent photographer to take construction record photographs prior to start of work and periodically during the course of the Work.
- B. Related Requirements Described Elsewhere:
 - 1. Project Requirements: Section 01000
 - 2. Summary of Project: Section 01010
 - 3. Project Record Documents: Section 01720

1.02 PHOTOGRAPHY REQUIRED

- A. Photographs taken in conformance with this Section shall be furnished to the Engineer with each pay request.
- B. Photographs shall be taken at each of the major stages of construction and as directed by the Engineer.
- C. Photographs may be taken by the Contractor's personnel but must be of professional quality as herein specified. Photographs deemed unsatisfactory will be rejected and retakes will be required.
- D. Views and Quantities Required:
 - 1. Six (6) prints of one (1) view of each activity as directed by the Engineer, up to a limit of twenty (20) activities photographed per month.
 - 2. Six (6) prints of five (5) views of overall project site monthly, as directed by the Engineer.
 - 3. Six (6) prints of each side of each structure on site where construction activities are present monthly.
 - 4. Two (2) prints of three (3) views of preliminary aerial photographs of the site prior to commencement of construction activities.

5. Two (2) prints of three (3) views of preliminary aerial photographs of the site to be taken and submitted monthly with each pay request.
 6. Two (2) prints of three (3) views of preliminary aerial photographs of the site upon completion of the project.
 7. Five (5) prints of selected aerial photographs enlarged for framing from the preliminary set of aerial photos.
- E. Negatives:
1. The photographer shall maintain negatives of the entire Project and then shall convey the negatives to the Owner at the completion of the Project.
 2. The photographer shall agree to furnish additional prints to Owner and the Engineer at commercial rates applicable at time of purchase.

1.03 COST OF PHOTOGRAPHY

- A. The Contractor shall pay costs for specified photography and prints. Parties requiring additional photography or prints will pay the photographer directly.

PART 2 - PRODUCTS

2.01 PRINTS

- A. Type of Print:
1. Paper: Single weight, color print paper.
 2. Finish: Smooth surface, glossy.
 3. Size: 8 inch x 10 inch for construction photos and preliminary aerial photos, 16 inch x 20 inch for selected aerial photos.
- B. Identify each print on back, listing:
1. Name of project
 2. Orientation of view
 3. Date and time of exposure

4. Name and address of photographer
 5. Photographer's numbered identification of exposure
- C. Aerial Photographs: Each aerial photograph shall be scaled to picture the plant site within no less than 80 percent of the print total area. Each selected enlarged aerial print shall be provided mounted within a black frame, non-glare glass front, behind a minimum 2 inch wide, two-tone, double beveled mat.

PART 3 - EXECUTION

3.01 TECHNIQUE

- A. Factual Presentation.
- B. Correct exposure and focus.
 1. High resolution and sharpness
 2. Maximum depth-of-field
 3. Minimum distortion

3.02 VIEWS REQUIRED

- A. Photograph from locations to adequately illustrate condition of construction and state of progress.
 1. At successive periods of photography, take at least one photograph from the same overall view as previously photographed.
 2. Consult with the Engineer at each period of photography for instructions concerning views required.

3.03 DELIVERY OF PRINTS

- A. Deliver prints to the Engineer to accompany each Application For Payment.
- B. Distribution of construction prints as soon as processed is anticipated to be as follows:
 1. Owner (two (2) sets)
 2. Engineer (two (2) sets)

3. Project record file (one (1) set to be stored by Contractor until the end of the project which shall be delivered with Project Record Documents as specified in Section 01720).
4. Contractor (one (1) set)

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Contractor will employ and pay for services of an Independent Testing Laboratory to perform testing specifically indicated on the Contract Documents or specified in the Specifications and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.
2. Contractor shall cooperate with the laboratory to facilitate the execution of its required services.
3. The Contractor shall provide Engineer with all test results herein within five (5) days of receipt.

B. Related Requirements Described Elsewhere:

1. Conditions of the Contract.
2. Respective section of the Specifications: Certification of products.
3. Each Specification section listed: Laboratory tests required, and standards for testing.
4. Testing laboratory inspection, sampling and testing is required for, but not limited to the following:
 - a. Excavating, Trenching, Backfilling and Compacting: Section 02220
 - b. Cast-in-Place Concrete: Section 03300.

C. The following schedule defines the responsibilities of various tests.

Test	Notes	Paid for By
Soil Compaction	Pipe Work: every 300 ft. at each lift of compaction minimum. Beneath Structures: each 500 SF each lift of compaction minimum.	Contractor
Pressure	As specified in Section 15044.	Contractor
Bacteriological	As required by local and state agencies.	Contractor
LBR	Each 600 SF of pavement minimum.	Contractor
Concrete	Slump test each delivery and compression test five cylinders every 50 C.Y. minimum.	Contractor

D. Additional Tests: In the event that first test samples do not meet the applicable material specification, the Contractor shall take measures to conform the material and equipment to the Specifications. All tests required to show compliance with the Specifications shall be paid for by the Contractor.

1.02 LABORATORY DUTIES: LIMITATIONS OF AUTHORITY

- A. Cooperate with Engineer and Contractor; provide qualified personnel promptly on notice.
- B. Perform specified inspections, sampling and testing of materials and methods of construction:
 - 1. Comply with specific standards; ASTM, other recognized authorities, and as specified.
 - 2. Determine and report on compliance with requirements of Contract Documents.
- C. Promptly notify the Engineer and Contractor of material or operations which do not meet the specifications.

- D. Promptly submit five (5) copies of reports of inspections and tests to the Engineer including:
 - 1. Date issued.
 - 2. Project title and Engineer's job number.
 - 3. Testing Laboratory name and address.
 - 4. Name and signature of inspector.
 - 5. Date of inspection or sampling.
 - 6. Record of temperature and weather.
 - 7. Date of test.
 - 8. Identification of product and Specification section.
 - 9. Location in project.
 - 10. Type of inspection or test.
 - 11. Compliance with Contract Documents or not.
- E. Perform additional services as required by Owner.
- F. Laboratory is not authorized to:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Approve or reject any portion of work.
 - 3. Perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel. Provide access to Work and manufacturer's operations.
- B. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.

- C. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacturer 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 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.
- D. Furnish incidental labor and facilities:
 - 1. To provide access to Work to be tested.
 - 2. To facilitate inspections and tests.
- E. Notify laboratory a minimum of three (3) working days in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Provide temporary facilities required which shall include but are not necessarily limited to the following:

1. By Contractor:
 - a. Telephone.
 - b. Storage sheds.
 - c. Temporary water service.
 - d. Temporary sanitary facilities.
 - e. Temporary electrical service.
 - f. Contractor's Field office.
2. By Owner:
 - a. None.

1.02 TEMPORARY WATER

A. Furnish and install temporary water service for use throughout construction period.

1. Water for construction purposes.
2. Water for other purposes.
 - a. Testing.
 - b. Temporary sanitary facilities.
 - c. Cleaning.

- d. Potable water source (separate).
- B. Maintain adequate volume of water for all purposes.
- C. Water Source:
 - 1. Non-potable water supplier: Columbia County water supply system
 - 2. Potable (bottled) water to be supplied by the Contractor.
- D. Maintain strict supervision of use of temporary services.
 - 1. Enforce conformance with applicable codes and standards.
 - 2. Enforce sanitary practices.
 - 3. Prevent waste of water.
 - 4. Prevent abuse of services.
- E. Costs of Installation and Operation: Pay costs for water used by all trades, including costs of installation, maintenance, and removal of pipe, meters, and equipment.
- F. Requirements of Regulatory Agencies:
 - 1. Obtain, pay for permits, fees, deposits required by governing authorities.
 - 2. Comply with federal, state and local codes.

1.03 TEMPORARY ELECTRICITY

- A. Furnish and install temporary electric power service for construction needs throughout construction period.
 - 1. Power centers for miscellaneous tools and equipment used in construction work.
 - a. Locate so that power is available at any desired point with no more than 100 feet extension.
 - b. Provide weatherproof distribution box with minimum of four (4), 20 amp, 120 volt grounded outlets with GFCI protection.
 - c. Provide circuit breaker protection for each outlet.

- d. Provide equipment grounding continuity for entire system.
 - e. Users shall provide grounded, Underwriters Laboratories, Inc. (UL) approved extension cords from power center to point of operations.
- 2. Power for construction equipment.
- 3. Power for testing and checking equipment.
- 4. Power for welding units and for other equipment having special power requirements.
- 5. Power for Contractors, Subcontractors and Owner/Engineer's field offices.
- B. Capacity:
 - 1. Adequate electrical service for construction use by all trades during construction period.
 - 2. Notify Power Company if unusually heavy loads such as welding, and other special power requirements, will be connected.
 - a. Provide special circuits for heavy load requirements.
 - b. Do not overload any circuit.
- C. Power Source:
 - 1. Supplier: Clay Electric
 - 2. Provide minimum 240 volt, single phase, 60 hertz power service to project site. The use of portable generators is allowed, however, it is recommended to disconnect the temporary power from the Clay Electric metered power supply prior to using portable generators.
- D. Maintain strict supervision of use of temporary services:
 - 1. Enforce conformance with applicable standards.

2. Enforce safe practices.
 3. Prevent abuse of services.
- E. Costs of Installation and Operation: Pay costs of temporary electrical power used, including costs of installation, meter, maintenance, and removal of temporary services from point of connection.
- F. Requirements of Regulatory Agencies:
1. Obtain and pay for permits as required by governing authorities.
 2. Comply with applicable codes.
 - a. National Electrical Code.
 - b. National Electrical Safety Code.
 - c. National Fire Protection Association.
 - d. Federal, state and local codes and utility company regulations.

1.04 TEMPORARY SANITARY FACILITIES

- A. Furnish and install temporary sanitary facilities for use throughout construction period.
1. Potable water for construction personnel:
 - a. Portable containers to dispense drinking water.
 - b. Maintain temperature between 45 degrees Fahrenheit (°F) (7.5 degrees C) and 55 °F (13 degrees C).
 2. Enclosed toilet facilities for construction personnel.
 3. General employee washing facilities.
- B. Minimum number of fixtures:
1. Toilets and Urinals
 - a. For less than 20 employees: One (1) toilet.
 - b. For 20 or more employees: One (1) toilet and 1 urinal per 40 workers.

2. Washing Facilities: Adequate for number of employees, for type of work requiring washing facilities.
- C. Maintain strict supervision of use of facilities:
1. Enforce conformance with applicable standards.
 2. Maintain, service and clean facilities.
 3. Enforce proper use of sanitary facilities.
- D. Cost of Installation and Operation:
1. Pay costs of temporary sanitary facilities, including costs of installation, maintenance and removal.
 2. Costs of Water: As specified in Paragraph 1.02C.2., herein.
 3. Pay service charges for use of portable sanitary units.
- E. Facility Locations:
1. Within the project site.
 2. Drinking Water: Convenient to work stations.
 3. Toilet and washing facilities.
 - a. Secluded from public observation.
 - b. Convenient for use of personnel in relation to work stations.
 4. Obtain acceptance of Engineer and Owner.
- F. Enclosure for Toilet Facilities:
1. Weatherproof, sightproof, sturdy temporary enclosures.
 2. Insect-proof screening, adequate natural ventilation.

G. Requirements of Regulatory Agencies:

1. Obtain and pay for permits as required by governing authorities.
2. Comply with federal, state, and local codes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. Materials may be new or used, but must be adequate for purpose required, sanitary and must not violate requirements of applicable codes.
2. At Contractor's option, patented specialty products may be used, in compliance with applicable codes.

2.02 ELECTRICITY (See Section 1.03)

- A. Comply with Division 16: Electrical.
- B. Provide required facilities, including transformers, conductors, poles, conduits, raceways, breakers, fuses and switches.
- C. Provide appropriate enclosures for environment in which used, in compliance with NEMA standards.

2.03 TEMPORARY SANITARY FACILITIES (See Section 1.04)

A. Drinking Water Facilities (Portable Containers):

1. Tightly closed, and equipped with dispensing tap.
2. Clearly label contents.
3. Do not use for other purposes.
4. Provide single-service disposable cups, with sanitary container for unused cups, and waste receptacles for used cups.

B. Toilet Facilities

1. Portable Toilets; either:
 - a. Chemical toilets.

b. Recirculating toilets.

c. Combustion toilets.

2. Toilet Tissue: Provide at each toilet, on suitable dispenser.

2.04 CONTRACTOR'S FIELD OFFICE AND FACILITIES

A. Specific Requirements:

1. Provide either a separate building or a trailer of adequate floor space for Contractor's use.
2. The trailer shall be weather-tight, have a tight level floor at least 8 inches off the ground, and shall be insulated, have suitable screened ventilation and a solid door.
3. The office shall be provided with janitor service, heating equipment, water, electrical wiring, outlets, and fixtures suitable to light the tables and desk adequately. Toilet facilities are to be included with a holding tank to be pumped clean daily by the Contractor. Garbage shall be collected daily and clean-up of the trailer shall be provided three (3) times per week.
4. Lighting and Temperature Control: Window air conditioning unit capable of maintaining the trailer at 70 to 80°F, but a minimum of 12,000 BTU (1 ton) rating.

B. Furniture and Equipment: The office shall have the following furniture and equipment:

1. Telephone: One (1) direct line instrument.
2. Racks and file for Project Record Documents.
3. Facsimile machine on a dedicated line.
4. Other furniture and furnishings: Contractor's option.

- C. Within ten (10) days after Notice to Proceed, submit a sketch showing proposed number and locations; including storage sheds and trailers. The Contractor shall locate all temporary construction offices and storage trailers where approved by the Owner and the Engineer.

2.05 TEMPORARY PARKING

- A. Provide a location, approved by the Engineer, for a gravel or other suitable surface for Contractor's employee, Engineer representatives and visitor parking. Personal vehicles will be restricted from the work area.
- B. Provide gravel parking space at the Contractor's trailer for a minimum of eight (8) vehicles. Provide gravel parking space at the Engineer's field office for a minimum of four (4) vehicles.

2.06 SECURITY LIGHTING

- A. Provide for adequate pole mounted floodlights for parking area at the Contractor and Engineer's trailer areas. Maintain lighting on a photocell or timer.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install work in a neat and orderly manner.
- B. Make structurally sound throughout.
- C. Maintain to provide continuous service.
- D. Modify and extend service as work progress requires.

3.02 TEMPORARY WATER

- A. Locate piping and outlets.
 - 1. Provide service convenient to work stations.
 - 2. Avoid interference with:
 - a. Traffic and work areas.
 - b. Materials handling equipment.
 - c. Storage areas.

- B. Do not run piping on floor or on ground.
- C. When necessary to maintain pressure, provide temporary pumps, tanks, and compressors.

3.03 TEMPORARY ELECTRICITY

- A. Service and distribution may be overhead or underground.
- B. Locate to avoid interference with:
 - 1. Traffic and work areas.
 - 2. Cranes.
 - 3. Material handling equipment.
 - 4. Storage areas.
- C. Do not run branch circuits on floor or on ground.
- D. Wire all safety devices specified for final operation of equipment.
- E. Check operation of safety devices.

3.04 TEMPORARY SANITARY FACILITIES

- A. Portable Toilets:
 - 1. Erect securely, and anchor to prevent dislocation or tipping over.
 - 2. Service as often as necessary to prevent accumulation of wastes, and creation of unsanitary conditions.
 - 3. Use only unless sewer and water service can be provided to site.
- B. Washing Facilities: Provide faucets, drains and other washing facilities suitable for the type of work requiring washing.

3.05 REMOVAL

- A. Completely remove temporary materials and equipment upon completion of construction.
- B. Clean, and repair damage caused by installation and restore to specified, or original condition.

END OF SECTION

SECTION 01505

MOBILIZATION

PART I - GENERAL

1.01 DEFINITION AND SCOPE

- A. Mobilization shall include the costs of obtaining all permits, insurance and bonds, moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the Work. Mobilization shall include, but not be limited to, the following principal items.
1. Move onto the site all Contractor's plans and equipment required for first month operations.
 2. Install temporary construction power, wiring, and lighting facilities.
 3. Establish fire protection plan and safety program.
 4. Secure construction water supply.
 5. Provide field office trailers for Contractor and as may be specified for Owner and Engineer.
 6. Provide on-site sanitary facilities and potable water facilities as specified.
 7. Arrange for and erect Contractor's work and storage yard and employee's parking facilities.
 8. Submit all required insurance certificates and bonds.
 9. Obtain all required permits.
 10. Post all OSHA, EPA, Department of Labor, and all other required notices.
 11. Have Contractor's superintendent at the job site full time.
 12. Submit a detailed construction CPM schedule acceptable to the Engineer as specified.
 13. Submit a schedule of values of the Work.

14. Submit a schedule of submittals.

1.02 DEMOBILIZATION

- A. Demobilization is the timely and proper removal of all contractor owned material, equipment or plant, from the job site and the proper restoration or completion of work necessary to bring the site into full compliance with the contract documents.

1.03 PAYMENT FOR MOBILIZATION/DEMOBILIZATION

- A. The Contractor's attention is directed to the condition that payment for mobilization or any part thereof, shall not exceed 3 percent (3 %) of the total contract price.

END OF SECTION

SECTION 01525
CONSTRUCTION AIDS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish, install and maintain required construction aids, remove on completion of Work.
- B. Related Requirements Described Elsewhere:
 - 1. Summary of Project: Section 01010.
- C. Comply with applicable requirements specified in Sections of Divisions 2 through 16.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials may be new or used, suitable for the intended purpose, but must not violate requirements of applicable codes and standards.

2.02 CONSTRUCTION AIDS

- A. Provide construction aids and equipment required by personnel and to facilitate execution of the Work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment such as temporary valves and fittings. Refer to respective Sections for particular requirements for each trade.
- B. When permanent stair framing is in place, provide temporary treads, platforms and railings, for use by construction personnel.
- C. Maintain facilities and equipment in first-class condition.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Consult with the Engineer, review site conditions and factors which affect construction procedures and construction aids, which may be affected by execution of the Work.

3.02 GENERAL

- A. Comply with applicable requirements specified in sections of Divisions 2 through 16.
- B. Relocate construction aids as required by progress of construction, by storage of work requirements and to accommodate legitimate requirements of Owner and other contractors employed at the site.

3.03 REMOVAL

- A. Completely remove temporary materials, equipment and services:
 - 1. When construction needs can be met by use of permanent construction.
 - 2. At completion of work.
- B. Clean and restore areas damaged by installation by use of temporary facilities.
 - 1. Remove foundations and underground installations for construction aids.
 - 2. Grade and grass areas of site affected by temporary installations to required elevations, slopes, ground cover and clean the area.
- C. Restore permanent facilities used for temporary purposes to specified condition or in kind if not specified.

END OF SECTION

SECTION 01568

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as required by Rules and Regulations and permit conditions.
2. Temporary erosion controls include, but are not limited to, grassing, mulching, setting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner.
3. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner, and by conditions of the NPDES permit.
4. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

B. Related Work Described Elsewhere:

1. Excavating, Trenching, Backfilling, and Compacting: Section 02220
2. Loaming, Seeding and Mulching: Section 02922.
3. Solid Sodding: Section 02934

PART 2 - PRODUCTS

2.01 EROSION CONTROL

- A. Sodding is specified in Section 02934.
- B. Netting shall be fabricated of material acceptable to the Owner.

2.02 SEDIMENTATION CONTROL

- A. Bales shall be clean, seed-free cereal hay type.
- B. Netting shall be fabricated of material acceptable to the Owner.
- C. Filter stone shall be crushed stone which conforms to Florida Department of Transportation (FDOT) specifications.
- D. Concrete block shall be hollow, non-load bearing type.
- E. Concrete shall be exterior grade not less than 1-inch thick.

PART 3 - EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for grassing are:
 - 1. Scarify slopes to a depth of not less than 6 inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
 - 2. Sow seed within 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. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stone which is dislodged shall be replaced.

3.03 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of Florida, the Owner, or Engineer, the Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work:
 - 1. Furnish, install and maintain project signs.
 - 2. Remove signs on completion of construction.
 - 3. Allow no other signs to be displayed.
- B. Related Requirements Described Elsewhere:
 - 1. Summary of Project: Section 01010.
 - 2. Painting: Section 09900.

1.02 ARRA REQUIRED PROJECT IDENTIFICATION SIGNS

- A. Requirements
 - 1. Contractor shall furnish, install and maintain a 4' x 8' project identification sign.
 - 2. The sign shall remain in place and become the property of the owner upon completion of construction.
 - 3. The sign shall be complete and properly installed no later than 20 days beyond the date of the notice to proceed.
 - 4. The engineer shall furnish the contractor with lettering and logo information for the sign.
- B. Quality Assurance
 - 1. Sign Painter: Professional experience in the type of work required.
 - 2. Finishes, Painting: adequate to resist weathering and fading for a two (2) year period.
- C. Sign Materials
 - 1. Structure and Framing: Shall be new pressure treated wood, in sound condition structurally adequate to work and suitable for specified finish. The sign shall be supported by 4" x 4" posts with a 2" x 4" frame.
 - 2. Sign Surfaces: Exterior 3/4" type A-C softwood plywood
 - 3. Rough Hardware and Nails: Galvanized.

4. Paint: Exterior quality enamel paint.

D. Project Identification Sign

1. Contractor shall construct the project sign as shown on the drawings or as described herein.
2. Paint exposed surfaces of supports, framing and surface material; one coat of primer and one coat of white exterior paint.
3. Paint graphics in black style in the sizes shown on the drawings or as finished by the Engineer. ARRA and FDEP graphics and color information shall be as shown on the attached sketch.
4. Erect signs in the numbers and locations stated below, in the areas at high public visibility, as approved by the Engineer and Owner.

E. Maintenance

Maintain signs and supports in a neat, clean condition; repair damages to structure, framing or sign.

F. Removal

Contractor shall not remove signs. Sign shall become property of the owner.

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: As required by the Owner, or as appropriate to usage.
2. Color: As required by the Owner, otherwise of uniform colors throughout Project.

B. Erect at appropriate locations to provide required information.

C. Information:

1. Contractor's name and home office address.
2. List of subcontractors and type of subcontract work.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 SUBMITTALS

- A. An 11-inch by 17-inch sketch of the project sign shall be submitted to the Engineer for approval prior to final preparation of the project sign.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: May be new or used, wood or metal, in sound condition, structurally adequate 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 Section 09900: Painting.

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGNS

- A. Paint exposed surface of supports, framing and surface material; one coat of primer and one coat of exterior paint.
- B. Paint graphics in styles, sizes, and colors selected.

3.02 MAINTENANCE

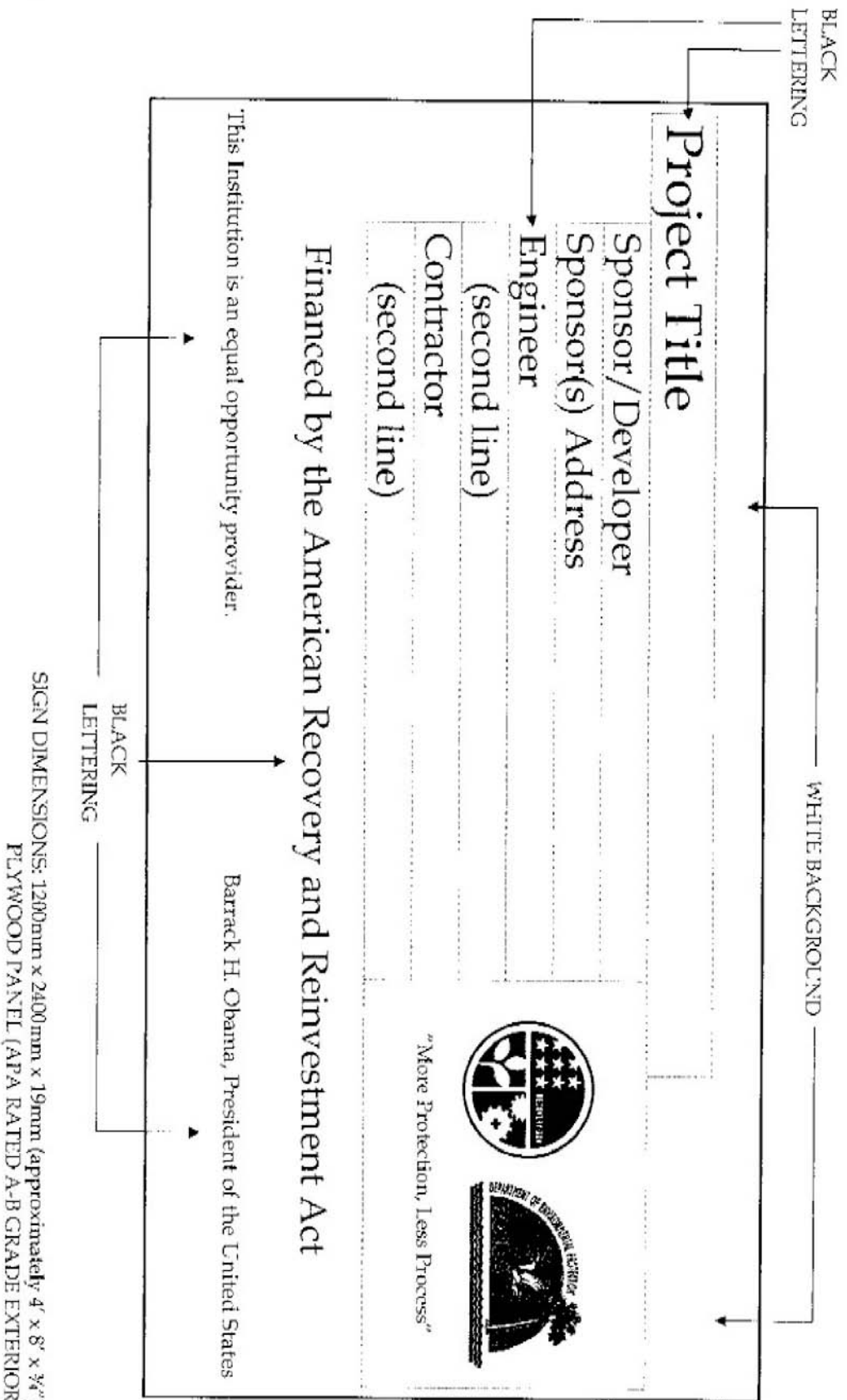
- A. Maintain signs and supports in a neat, clean condition; repair damages to structures, framing or signs.

3.03 REMOVAL

- A. Remove signs, framing, supports and foundations at completion of project.

END OF SECTION

Temporary construction sign for American Recovery and Reinvestment Act (ARRA) projects



SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Material and equipment incorporated into the Work:
 - 1. Manufactured and fabricated products:
 - a. Design, fabricate and assemble in accord with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Two (2) or more items of the same kind shall be identical, 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.
 - 2. Do not use material or equipment for any purpose other than that for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- 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 five copies of the Engineer.
 - 1. Maintain one (1) set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

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 Contract Documents.

1.03 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of products in accordance with progress 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. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc. Corroded, damaged or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.
- B. Store products in accord 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 manufacturer's instructions.
 3. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with

impervious sheet coverings, provide adequate ventilation to avoid condensation.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- D. Cement, sand and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural and miscellaneous steel, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete beams shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling to a minimum.
- E. All materials, which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work, and the Contractor shall receive no compensation for the damaged material or its removal.
- F. 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.
- G. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.
- H. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
- I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven (7) days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised

of expenditures for labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary corrections.

1.05 STORAGE AND HANDLING OF EQUIPMENT ON SITE

- A. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed:
1. Materials shall not be shipped until approved by the Engineer. The intent of this requirement is to avoid unnecessary delivery of unapproved materials and to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall major equipment or finish products be delivered to the site more than one month prior to installation without written authorization from the Engineer. Materials shipped to the site, or temporarily stored off-site in approved locations, shall be stored in accordance with Paragraph 1.04, herein.
 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 by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.
 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 the 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. Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the Owner.
 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 guarantee 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.

1.06 SPARE PARTS

- A. Spare parts for certain equipment provided under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

1.07 GREASE, OIL AND FUEL

- A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.
- B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three (3) weeks of operation.

END OF SECTION

SECTION 01650

START-UP AND DEMONSTRATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Demonstrate to Owner and Engineer that the Work functions as a complete and operable system under normal and emergency operating conditions.
- B. Contractor shall provide all materials, personnel, equipment and expendables as needed and as specified to perform the required start-up and demonstration tests.
- C. Related Work Described Elsewhere:
 - 1. Hydraulic Test on Concrete Tankage Form: Section 00855.
 - 2. Check-Out Form: Section 00865.
 - 3. Certificate of Completed Demonstration Form: Section 00866.
 - 4. Construction Progress Schedules: Section 01310.

PART 2 - PRODUCTS

2.01 START-UP PLAN

- A. Submit for approval by the Engineer a detailed start-up plan outlining the schedule and sequence of all tests and start-up activities, including submittal of checkout forms, submittal of demonstration test procedures, start-up, demonstration and testing, submittal of certification of completed demonstration and training. Start-up and commissioning may not begin until the plan is approved by the Engineer.

PART 3 - EXECUTION

3.01 COMPONENT TEST AND CHECK-OUT

- A. Start-up Certification: Prior to system start-up, successfully complete all the testing required of the individual components of the Work. Submit six (6) copies of Check-Out Forms for each individual component or piece of equipment, signed by the Contractor or the subcontractor and the manufacturer's representative. All copies of the Operation and Maintenance Manuals must be provided before start-up may begin. These forms shall be completed and

submitted before Instruction in Operation to Owner or a request for initiating any final inspections. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.

- B. Demonstrate to the Engineer and the Owner's representative, that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.
- C. Coordinate start-up activities with the Owner and with the Engineer prior to commencing system start-up.

3.02 START-UP

- A. Confirm that all equipment is properly energized, that the valves are set to their normal operating condition, and that the flow path through the new work is unobstructed.
- B. Slowly fill each hydrostatic structure in the process flow stream with water.
- C. Initiate start-up and training in accordance with and with the use of the plant operation and maintenance manuals.
- D. Observe the component operation and make adjustments as necessary to optimize the performance of the Work.
- E. Coordinate with Owner for any adjustments desired or operational problems requiring debugging.
- F. Make adjustments as necessary.

3.03 START-UP DEMONSTRATION AND TESTING

- A. After all Work components have been constructed, field tested, and started up in accordance with the individual Specifications and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Start-Up Demonstration and Testing in the presence of the Engineer and Owner. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon in writing by the Owner or his representative.
- B. The Start-Up Demonstration Testing will be conducted for seven (7) consecutive days. The Work must operate successfully during the seven (7) day testing period in the manner intended. If the Work does not operate successfully, or if the start-up is interrupted due to other contracts, the problems will be corrected and the test will start over from day one. The party causing the interruption will be subject to the assessment of actual damages due to delay.

- C. During the start-up demonstration period, operate the Work, instruct designated plant operating personnel in the function and operation of the Work, and cause various operational circumstances to occur. As a minimum, these circumstances will include average and peak daily flows, random equipment or process failures, tank overflows, surcharges, interlocks and bypasses. Demonstrate the essential features of the equipment and its relationship to other equipment. The approved schedule of operational circumstances and Demonstration Test Procedures Forms will be used as the agenda during the Start-Up Demonstration Testing period for all equipment and sections of the Work. Coordination of the demonstration test schedule will be accomplished through the Engineer.
- D. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions, to provide wastewater treatment facilities functioning as intended and as defined in the Contract Documents. The intent of the start-up demonstration and testing is for the Contractor to demonstrate to the Owner and the Engineer that the Work will function as a complete and operable system under normal, as well as emergency operating conditions, and is ready for final acceptance.
- E. Demonstrate the essential features of the whole system as it applies to the Work, including the mechanical equipment, piping, structures, finishes, controls, instrumentation, power distribution and lighting systems. Use the approved procedures and circumstances to demonstrate the system. Any minor deficiencies found shall be noted and included on a punch list attached to the Certificate of Completed Demonstration. The system shall be demonstrated only once, after completion of start-up tests. If circumstances arise that interrupt the test procedures (such as weather, unforeseen process problems, or problems caused by the Contractor whether or not the problems are the fault of the Contractor, etc.,) then the test shall be terminated and rescheduled to a later date after the problem is corrected. The test shall be run in its entirety if so directed by the Engineer.
- F. Demonstrate the essential features of all the mechanical systems including, but not limited to, the following as they apply to the Work:
 - 1. Anoxic Basin Submerged Mixers
 - 2. Aeration Basin Diffused Aeration System Aerators
 - 3. WAS Pumps
 - 4. RAS Pumps
 - 5. Chlorination System (Liquid and Gas)
 - 6. Effluent Transfer pumps

7. In-Plant Flow Meters
 8. Instrumentation
 9. Mechanical Systems:
 - a. Valves
 - b. Pumps
- G. Demonstrate the essential features of all electrical systems including, but not limited to, the following as they apply to the Work:
1. Electrical systems controls and equipment.
 - a. Electrical power equipment
 - b. Motor control centers
 - c. Motor control devices
 - d. Relays
 - e. Special transformers
 - f. Starting devices
 2. Panelboards
 - a. Distribution panels
 - b. Lighting panels
 - c. Main panels, power panels

- d. Switchboard
- 3. Wiring devices
 - a. Face plates
 - b. Low-voltage controls
 - c. Outlets: convenience, special purpose
 - d. Switches: regular, time
- H. Upon successful completion of the Start-up, Demonstration and Testing, the Owner's personnel will receive the specified training for each system. Training of the Owner's personnel will not be considered valid unless it takes place using a system that has successfully passed the Start-up, Demonstration and Testing.
- I. Upon completion of all specified operator training, the Contractor shall submit to the Engineer six (6) copies of the Certificate of Completed Demonstration Form, for each item of equipment or system in the Work, signed by the Contractor, Subcontractor, Engineer, and the Owner. Insert one (1) copy of this form in the applicable section of each Operation and Maintenance Manual. A sample Certificate of Completed Demonstration Form is provided in Section 00866.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Comply with requirement stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.
- B. Related Requirements Described Elsewhere:
 - 1. Cleaning: Section 01710.
 - 2. Project Record Documents: Section 01720.
 - 3. Operating and Maintenance Data: Section 01730.
 - 4. Warranties and Bonds: Section 01740.

1.02 SUBSTANTIAL COMPLETION

- A. The Work will not be substantially complete, and Contractor may not request substantial completion inspection unless the following submittals and work is completed:
 - 1. All Operation and Maintenance manuals have been submitted and approved to the requirements of Section 01730.
 - 2. Project Record Documents are complete and have been submitted and reviewed to the requirements of Section 01720.
 - 3. All training of Owner's personnel completed.
 - 4. All areas to be used and occupied are safe, operable in automatic and complete.
 - 5. All building occupancy certificates have been issued by the appropriate building permitting agency.
 - 6. All painting, finishes, fencing, cleanup, final grading, grassing, planting, sidewalk construction, and paving shall have been completed and ready for inspection.

7. All deficiencies noted on inspection reports or nonconformances are corrected or the correction plan approved.
- B. When the conditions of paragraph 1.02 A. are met the Contractor shall submit to the Engineer:
1. A written notice that he considers the Work, or portion thereof, is substantially complete, and request an inspection.
 2. A punchlist of items to be corrected. (Uncompleted work which is not related to the safe, effective, efficient use of the Project may be allowed on the punchlist with the Engineer's approval.)
- C. Within a reasonable time after receipt of such notice, the Engineer will make an inspection to determine the status of completion.
- D. Should the Engineer determine that the Work is not substantially complete:
1. The Engineer will promptly notify the Contractor in writing, giving the reasons therefor.
 2. Contractor shall remedy the deficiencies in the Work and send another written notice of substantial completion to the Engineer.
 3. The Engineer will within reasonable time, reinspect the Work. The Contractor will be liable for reinspection fees as described in paragraph 1.04, herein.
- E. When the Engineer finds that the Work is substantially complete, he will:
1. Schedule a walk-through of the facility to include the Owner. Engineer shall determine the completeness of the punchlist and readiness of the facility for occupancy by the Owner.
 2. Prepare and deliver to Owner a tentative Certificate of Substantial Completion with the tentative punchlist of items to be completed or corrected before final inspection.
 3. After consideration of any objections made by the Owner as provided in Conditions of the Contract, and 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 with a revised tentative list of items to be completed or corrected. Any incomplete work allowed on a punchlist must be reinspected upon completion and any deficiencies found will be added to the punchlist.

1.03 FINAL INSPECTION

- A. Prior to Contractor's request for a final inspection the following submittals and work must be complete:
 - 1. Project Record Documents must be approved.
 - 2. All spare parts and maintenance materials must be suitably delivered to the Owner per the requirements of the Technical Sections of the Specifications.
 - 3. Contractor to submit evidence of compliance with requirements of governing authorities.
- B. After satisfying the requirements of paragraph 1.03 A. and when Contractor considers the Work complete, he shall submit written certification that:
 - 1. Contract Document requirements have been met.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
 - 5. All punchlist items have been corrected or completed and the Work is ready for final inspection.
- C. The Engineer will, within reasonable time, make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- D. Should the Engineer consider that the Work is incomplete or defective:
 - 1. The Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send another written certification to the Engineer that the Work is complete.
 - 3. The Engineer will, within a reasonable amount of time, reinspect the Work and the Contractor shall be liable for reinspection fees as described in paragraph 1.04, herein.

- E. When the Engineer finds that the Work is acceptable under the Contract Documents, the Contractor may make closeout submittals.

1.04 REINSPECTION FEES

- A. Should the Engineer perform reinspections due to failure of the Work to comply with the claims of status of completion made by the Contractor:
 - 1. Contractor will compensate the Owner for such additional services.
 - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS

- A. Warranties and Bonds: To requirements of Section 01740.
- B. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- C. Certificate of Insurance for Products and Completed Operations.

1.06 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 or written amendment.
 - b. Allowances.
 - c. Unit prices.
 - d. Deductions for uncorrected work.
 - e. Penalties and bonuses.
 - f. Deductions for liquidated damages.
 - g. Deductions for reinspection payments.

- h. Other adjustments.
- 3. Total Contract Sum, as adjusted.
- 4. Previous payments.
- 5. Sum remaining due.
- C. Engineer will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

END OF SECTION

SECTION 01710

CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Execute cleaning, during progress of the Work and at completion of the Work.

1.02 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with 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 daily cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations or personal activities.
- 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, or as directed by the Owner, and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

- A. The Contractor shall employ construction techniques that minimize the production and distribution of dust.
- B. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- C. 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. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
- 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 DESCRIPTION

A. Scope of Work: Maintain at the site for the Owner one (1) record copy of:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications of 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.
9. As-Built Drawings.

B. Related Requirements Described Elsewhere:

1. Field Engineering: Section 01050.
2. Shop Drawings, Working Drawings and Samples: Section 01340.
3. Construction Photographs: Section 01380.

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 with section numbers as provided herein.
- 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 or the Owner.
- E. As a prerequisite for monthly Progress payments, the Contractor is to exhibit the currently updated "Record Documents" for review by the Engineer and Owner. Payment may be withheld if record documents are not satisfactorily maintained.

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" with a rubber stamp having one (1) inch high letters.
- B. Record information concurrently with construction progress.
 - 1. Do not conceal any work until required information is recorded.
- C. Drawings: Legibly and clearly mark, to scale, each drawing to record actual construction:
 - 1. Depths of various elements of foundation in relation to finish first floor datum.
 - 2. 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.
 - 3. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by Field Order or by Change Order.
 - 6. Details not on original Contract Drawings.

7. Equipment and piping relocations.
 8. Major architectural and structural changes including relocation of doors, windows, etc.
 9. Architectural schedule changes according to Contractor's records and shop drawings.
- D. Specifications and Addenda: Legibly mark each section to record:
1. Manufacturer, trade name, catalog number of Supplier of each product and item of equipment actually installed.
 2. Changes made by Field Order or by Change Order.
- E. Shop Drawings (after final review and approval): Provide six (6) sets of record shop drawings within the Operation and Maintenance Manual, for each process equipment, piping, electrical system and instrumentation system (see Section 01730).

1.05 SUBMITTAL

- A. At Contract closeout, deliver Record Documents to the Engineer for the Owner.
- B. Accompany submittal with transmittal letter in duplicate, containing:
1. Date.
 2. Project title and number.
 3. Contractor's name and address.
 4. Title and number of each Record Document including As-Built Drawings certified by a Florida Public Land Surveyor.
 5. Signature of Contractor or his authorized representative.

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract.
 - a. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

B. Related Requirements Described Elsewhere:

1. Contract Closeout: Section 01700
2. Project Record Documents: Section 01720

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.
2. Familiar with requirements of the Section.
3. Skilled as technical writer to the extent required to communicate essential data.
4. Skilled as draftsman competent to prepare required drawings.

1.03 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 inches x 11 inches.
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. Reduce larger drawings and fold to size of text pages but not larger than 14 inches x 17 inches.
5. Provide fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide typed description of projects and major component parts of equipment.
 - b. Provide identified tabs.
6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE MANUAL". List:
 - a. Title of Project.
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in the manual.
 - d. Identity of consulting engineer for the project.
 - e. Identity of general contractor for the project.

C. Binders:

1. Commercial quality , three D-ring type binders with durable and cleanable white plastic covers. Binders shall be presentation type with clear vinyl covers on front, back and spine. Binders shall include two sheet lifters and two, horizontal inside pockets.
2. Maximum D-ring width: 2 inches.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.04 CONTENT OF MANUAL

A. Each volume of the operation and maintenance manual shall include:

1. A neatly typewritten table of contents for each volume, arranged in systematic order by division, as listed within the product specifications.
2. Contractor, name of responsible principal, address and telephone number.
3. A list of each project required to be included, indexed to content of the volume.
4. List, with each project, name, address and telephone number of:
 - a. Subcontractor, manufacturer and installer name, addresses and telephone numbers.
 - b. A list of each product required to be included, indexed to content of the volume.
 - c. Identify area of responsibility of each product.
 - d. Local source of supply for parts and replacement equipment including name, address and telephone number.
5. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Design

1. Provide hydraulic and engineering design criteria for each product as it pertains to a particular unit process.
2. Provide a general description of each normal product operation as it pertains to a particular unit process.

C. Product Data:

1. Include only those sheets which are pertinent to the specific product. Hydraulic and engineering design criteria, information and procedures required for normal control, process control and performance evaluations, listing of spare parts required, maintenance and repair instructions, safety and personnel requirements and a "trouble shooting" problem guide shall be included in the manual. References to related products, manufacturer and equipment histories, product catalogs, etc. shall not be included within the content of the operation and maintenance manual.
2. Annotate each sheet to:
 - a. Clearly identify specific product or part installed.
 - b. Clearly identify data applicable to installation.
 - c. Delete references to inapplicable information.
3. Operation and maintenance information as herein specified.
4. Record shop drawings as submitted and approved with all corrections made for each product.

D. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Product assembly and disassembly for maintenance and repair procedures.
 - c. Control and flow diagrams.
 - d. Representation of manufacturer's recommended spare parts.
2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
3. Do not use Project Record Documents as maintenance drawings.

E. Written test, as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instruction of each procedure.
- F. Copy of each warranty, bond and service contract issued.
1. Provide information sheet for Owner's personnel, give:
 - a. Proper step-by-step procedures in the event of product failure.
 - b. Safety instructions for plant personnel in handling of failed equipment.
 - c. Instances which might affect validity of warranties or bonds.

1.05 MANUAL FOR MATERIALS AND FINISHES

- A. Submit six (6) copies of complete manual in final form.
- B. Content: for architectural products, applied materials and finishes:
1. Manufacturer's data, giving full information on products.
 - a. Catalog number, size, composition.
 - b. Color and texture designations.
 - c. Information required for reordering special manufacturing products.
 2. Instructions for care and maintenance.
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods which are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.
- C. Content, for moisture protection and weather-exposed products:
1. Manufacturer's data, giving full information on products.
 - a. Applicable standards.
 - b. Chemical composition.

- c. Details of installation.
- 2. Instructions for inspection, maintenance and repair.
- D. Additional requirements for maintenance data: Respective sections of Specifications.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit six (6) copies of complete manual in final form.
- B. Provide table of contents for each unit of equipment and system.
 - 1. List in entirety all sections pertinent to equipment operation and maintenance.
 - 2. Provide fly-leaf for each individual section identified by corresponding section number.
- C. Content, for each unit of equipment and system, as appropriate:
 - 1. Description of unit and component parts.
 - a. Provide general mechanical and process descriptions, normal operating characteristics, and limiting conditions.
 - b. Performance curves, engineering data and tests as pertains to the performance requirements as listed in the respective specifications.
 - c. Complete nomenclature and commercial number of replaceable parts.
 - d. Summary of information listed on equipment and motor data plates.
 - 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 in the event of equipment failure or emergency situations to insure uninterrupted plant operation. Provide step-by-step instruction to initiate process alternatives.
- 3. Maintenance procedures:
 - a. Provide instructions for maintenance procedures during routine operations.
 - b. Provide "trouble-shooting" guide.
 - c. Disassembly, repair and reassembly.
 - d. Alignment, adjusting and checking.
- 4. Servicing and lubrication schedules required, to insure maximum product performance.
- 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. Predicted life of parts subject to wear.
 - b. Items recommended to be stocked as spare parts with manufacturers part number.
- 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 respective sections of specifications.
- 13. Approved record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.

- D. Content, for each electric and electronic systems, 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 and 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 manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
 8. Other data as required under pertinent sections of specifications.

- E. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- F. Additional requirements for operating and maintenance data:
 - 1. Respective sections of Specifications.
 - 2. In addition to the operating and maintenance data specified herein, all manufacturers shall submit operating and maintenance data on magnetic media/floppy disks in Microsoft Word, Word Perfect or text, ".txt", formats. All graphic files shall be in BMP, PCX, CDR, JPEG, DWG or DXF formats. Such data will be utilized by the SCADA System integrator for compilation into hypertext window help files. Manufacturers will be required to review hypertext files compiled by the systems integrator for accuracy prior to introducing them into the SCADA System.

1.07 SUBMITTAL SCHEDULE

- A. Submit two copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 150 days after Notice to Proceed.
- B. Submit two copies of completed data in preliminary form no later than 30 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.
- C. Submit six (6) copies of approved manual in final form directly to the offices of the Engineer, Eutaw Utilities, Inc., within 10 days after the reviewed copy or last item of the reviewed copy is returned.
- D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to demonstration test, 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. Review contents of manual with Owner's operating and maintenance personnel in full detail to explain all aspects of operations and maintenance.

- C. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.
- D. The Contractor shall provide a list to the Owner indicating the date, time and instructors that will be present for all training sessions.
- E. The instructors shall provide for and prepare lesson scopes and handouts for up to five individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively. Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.
- F. All instruction sessions shall be video taped with portable video recording cameras and tapes supplied by the Contractor. Video taping shall be made by the Contractor under the direction of the Owner using VHS compatible video taping equipment.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work:
 - 1. Compile specified warranties and bonds, as in Article 5 and 13 of Section 00700: General Conditions and as specified in these Specifications.
- B. Related Work Described Elsewhere:
 - 1. General Conditions: Section 00700.
 - 2. Contract Closeout: Section 01700.

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 (2) each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product of 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 or 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 inches by 11 inches, punch sheets for standard three (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 (3) D-ring type binders with durable and cleanable white plastic covers and maximum D-ring width of two (2) inches. Binders shall be presentation type with clear vinyl covers on front, back, and spine. Binders shall include two sheet lifters and two horizontal inside pockets.

1.04 WARRANTY SUBMITTALS REQUIREMENTS

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of final acceptance by the Owner.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment specified under Divisions 11: Equipment; 13: Special Construction; 15: Mechanical; and 16: Electrical and which has at least a 1 hp motor or which lists for more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a one (1) year warranty commencing at the start of the Correction Period, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two (2) year warranty from the manufacturer shall not relieve the Contractor of the one (1) year warranty, starting at the time of Owner's acceptance of the equipment.

- D. The Owner shall incur no labor or equipment cost during the guarantee period.
- E. Guarantee shall cover all necessary labor, equipment, materials, and replacement parts resulting from faulty or inadequate equipment design, improper assembly or erection, defective workmanship and materials, leakage, breakage or other failure of all equipment and components furnished by the manufacturer or the Contractor.

END OF SECTION

SECTION 01800

MISCELLANEOUS WORK AND CLEANUP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This Section includes operations which cannot be specified in detail as separate items but can be sufficiently described as to the kind and extent to work involved. The Contractor shall furnish all labor, materials, equipment and incidentals to complete the work under this Section.
2. The work of this Section includes, but is not limited to, the following:
 - a. Restoring of fences.
 - b. Cleaning up.
 - c. Incidental work.

PART 2 - PRODUCTS

2.01 MATERIALS

- ###### A.
- Materials required for this Section shall be of the same quality as materials that are to be restored. Where possible, the Contractor shall reuse existing materials that are removed and then replaced.

PART 3 - EXECUTION

3.01 RESTORING OF FENCES

- ###### A.
- The Contractor shall remove, store and replace existing fences during construction. Only the sections directed by the Engineer shall be removed. If any section of fence is damaged due to the Contractor's negligence, it shall be replaced with fencing equal to or better than that damaged, and the work shall be satisfactory to the Engineer.

3.02 CLEAN UP

- A. The Contractor shall remove all construction material, buildings, equipment and other debris remaining on the job as the result of construction operations and shall render the site of the work in a neat and orderly condition. All suitable excess excavated material shall remain on site.

3.03 INCIDENTAL WORK

- A. Do all incidental work not otherwise specified, but obviously necessary for the proper completion of the contract as specified and as shown on the Drawings.

END OF SECTION

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This Section includes furnishing all labor, materials, equipment and incidentals required for selective site demolition.
2. This Section provides for the complete or partial removal and disposal of specified existing structures, foundations, slabs, piping, mechanical, electrical, existing (to be abandoned) piping and miscellaneous appurtenances encountered during construction operations.
3. This Section specifies certain activities necessary to maintain and facilitate operation during and immediately following construction and do not purport to cover all the activities necessary. The Contractor shall exercise due care for the existing treatment plant system operation and shall maintain continuous operation of the existing facilities and minimize operation inconvenience. In accordance with this requirement, a Demolition and Removal Plan shall be developed in accordance with Paragraph 1.06.
4. Demolition includes:
 - a. Demolition, partial removal and cutting of existing structures as required for the new construction.
 - b. Disposal of salvageable and excess unacceptable material as specified below.
 - c. Off-site disposal of excess and unacceptable materials.
5. The Contractor shall examine the various drawings regarding the proposed site, visit the proposed site and determine for himself the extent of the work, the extent of work affected therein and all conditions under which he is required to perform the various operations.
6. Specific structures to be partially or completely demolished are identified in the Construction Drawings.

1.02 PERMITS AND NOTICES

- A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the work and shall furnish a copy of same to the Engineer prior to commencing the work. The Contractor shall comply with the requirements of the permits.
- B. Notices: Contractor shall issue written notices of planned demolition to companies or local authorities owning utility conduit, wires or pipes running to or through the project site. Copies of said notices shall be submitted to the Engineer.
- C. Utility Services: Contractor shall notify utility companies or local authorities furnishing gas, water, electrical, telephone or sewer service to remove any equipment owned by them in structures to be demolished and to remove, disconnect, cap or plug their services to facilitate demolition.

1.03 CONDITIONS OF STRUCTURES

- A. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variation within the structure may occur prior to the start of demolition work.

1.04 RULES AND REGULATIONS

- A. The Standard Building Codes shall control any demolition, modification, or alteration of the existing buildings or structures.
- B. No blasting shall be done on site. The Contractor shall not bring or store any explosives on site.

1.05 DISPOSAL OF MATERIAL

- A. Salvageable material shall become the property of the Owner, if the Owner requests any specific item. The Contractor shall dismantle all materials to such a size that it can be readily handled, and deliver any of this salvageable material requested by the Owner to an on-site storage area designated by the Owner.
- B. The following materials are examples of the type that the Owner may retain ownership of:
 - 1. Pipes and valves greater than 3-inches in diameter (exclusive of buried pipe).
 - 2. All machinery and equipment.
 - 3. All electric panels.

- 4. Scrap aluminum or other valuable metals.
- C. Any materials that the Owner rejects shall become the Contractor's property and must be removed from the site.
- D. Concrete, concrete block and unsalvageable bricks shall be hauled to a waste disposal site by the Contractor.
- E. All other material shall be hauled to a waste disposal site by the Contractor.
- F. The storage of, or sale of, removed items on the site will not be allowed.

1.06 SUBMITTALS

- A. Submit to the Engineer for approval, two (2) copies of the proposed Demolition and Removal Plan for the structures and modifications as shown on the Drawings or as specified herein prior to the start of work. Include in the schedule the coordination of shutoff, capping and continuation of utility service as required. The Demolition and Removal Plan shall include, as a minimum, the following:
 - 1. A detailed sequence of demolition and removal work to insure the uninterrupted progress of the Owner's operations, and the expeditious completion of the Contractor's work.
 - 2. Evidence (by signature) of approval of the Owner's plant operator of the work plan.
- B. Before commencing demolition work, all modifications necessary to bypass the affected structure will be completed. Contractor shall coordinate with the Owner's personnel to determine the locations of the affected valves and fittings.
- C. The above procedure must be followed for each individual demolition operation.

1.07 TRAFFIC AND ACCESS

- A. Conduct demolition and modification operation, and the removal of equipment and debris to ensure minimum interference with roads, streets, and sidewalks both on-site and off-site, and to ensure minimum interference with occupied or used facilities.
- B. Contractor shall at all times maintain safe and convenient access to the existing site.

- C. Do not close or obstruct streets or walks without permission from the Owner and Engineer. Provide alternate traffic routes around closed or obstructed access ways.

1.08 DAMAGE

- A. Promptly repair damage caused to adjacent facilities by demolition operations at no cost to the Owner.

1.09 UTILITIES

- A. Maintain existing utilities to remain in service and protect against damage during demolition operations.
- B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized by the Owner and Engineer. Provide temporary services during interruption to existing utilities as required by the Owner.
- C. The Contractor shall cooperate with the Owner to shut off utilities serving structures of the existing facilities as required by demolition operations.
- D. The Contractor shall be solely responsible for making all necessary arrangements and for performing any necessary work involved in connection with the discontinuance or interruption of all public and private utilities or services under this jurisdiction of utility companies.
- E. All utilities being abandoned shall be disconnected and terminated at the service mains in conformance with the requirement of the utility companies or the municipality owning or controlling them.

1.10 POLLUTION CONTROL

- A. For pollution control, use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practical for the conditions or work. Comply with the governing regulations.
- B. Clean structures and improvements of all dust, dirt and debris caused by demolition operations as directed by the Engineer. Return areas to conditions existing prior to the start of work.

1.11 QUALITY CONTROL

- A. Protect all existing materials and equipment to be salvaged or reused from damage.

- B. Cap or plug all lines to be abandoned. Place covers and label all junction boxes, conduits and wire as abandoned.
- C. Leave all exposed ends of all pipe and conduit or junction boxes covered and safe.

1.12 ALLOWANCES

- A. All refurbishment costs to be included as part of the allowances shall be approved by the Engineer prior to encumbrance by the contractor. Demolition items shown on the Drawings or specified herein or items deemed to be obviously required for the Work shall be included in the Contractor's Bid Price.
- B. The allowance has been designated for unknown items such as quantity of grit and sand removal.
- C. Reimbursement for parts, materials, and labor required for refurbishment shall be paid at the invoice price for these items plus a ten (10) percent markup for administrative and overhead expenses. Any portion of the allowances not used by the Contractor will be deducted from the final Contract Price for the Project.
- D. The Contractor shall submit a summary of the costs to be paid out under this section along with the actual invoices for materials and testing services with his monthly pay request.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION

3.01 SEQUENCE OF WORK

- A. The sequence of demolition and renovation of existing facilities will be in accordance with the approved Demolition and Removal Plan as specified in Paragraph 1.06 of this Section. The Contractor is solely responsible for construction and demolition sequencing of the Work.

3.02 REMOVAL OF EXISTING PROCESS EQUIPMENT, PIPING AND APPURTENANCES

- A. Subject to the constraints of maintaining the existing plant in operation; existing equipment, non-buried valving and piping, and appurtenances not necessary for the operation of the new facility shall be removed or abandoned in-place as shown or indicated on the Drawings.
- B. All equipment, piping and appurtenances shall be cleaned, flushed and drained. Equipment to be retained by the Owner as specified in Paragraph 1.05 above shall

- C. The Contractor shall be responsible for draining the existing WWTP tankage to be modified. The drained material shall be transferred to the aeration basin for treatment. Solids remaining at the bottom of drained tankage such as sludge or grit shall be hauled off-site. No drained liquid containing grit shall be transferred to the aeration basin.
- D. Tanks to be modified shall be completely removed of all scum, dirt, debris and other material.

3.03 STRUCTURES TO BE COMPLETELY DEMOLISHED

- A. Existing structures shall be completely demolished as shown on the Drawings. Structures shall be demolished to make room for construction of new facilities, unless otherwise shown on the Drawings. All demolished material and equipment shall be removed from site.

END OF SECTION

1.0 GENERAL**1.1 DESCRIPTION**

A. The Work of this Section includes all labor, machinery, construction equipment and appliances required to perform in a good workmanlike manner all boring and jacking of pipeline casings and installation of pipe therein.

1. The overall work scope shall include, but not be limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, skid, steel straps, coatings, location signs as required, installation of the carrier pipe within the casings, miscellaneous appurtenances to complete the entire work as shown on the Construction Drawings, and restoration.

2. Boring and jacking operations shall be performed within the right-of-way and/or easements shown on the Construction Drawings.

B. The equipment used in boring and jacking casings shall be of adequate commercial size and satisfactory working condition for safe operation, and may be subject to approval by the County at the discretion of the Project Manager. Such approval, however, shall not relieve the Contractor of the responsibility for making a satisfactory installation meeting the criteria set forth herein. Only workmen experienced in boring and jacking operations shall be used in performing the Work.

C. Provide all structures, safety equipment, and professional services required to provide for the health and safety of the general public and of personnel involved in pipe boring and jacking work in accordance with the requirements of the regulatory agencies having jurisdiction.

D. Take all measures necessary to protect surrounding public and private property, adjacent buildings, roads, drives, sidewalks, drains, sewers, utilities, trees, structures, and appurtenances from damage due to pipe boring and jacking work. Responsibility and payment for correction of such damage shall be the sole responsibility of the Contractor.

1.2 REFERENCE DOCUMENTS

- A. American Society for Testing and Materials (ASTM).
- B. American Water Works Associations (AWWA).
- C. American Welding Society (AWS)

1.3 RELATED WORK

- A. Section 02221 Excavation and Backfill.
- B. Section 03300 Cast-in-Place Concrete.

2.0 PRODUCT

2.1 PIPE CASING

A. Steel pipe casings shall conform to the requirements of ASTM A139 (straight seam pipe only), Grade "B" with a minimum yield strength of 35,000 psi and be of a thickness equal to or exceeding the minimum gauge indicated on the Contract Drawings, and equal to or exceeding the requirements of the applicable governing agency. Pipe casing to be placed by jacking methods shall be of sufficient thickness and axial strength to withstand the forces to be encountered during the jacking process. The pipe shall be coated externally with coal-tar primer followed by hot coal-tar enamel in accordance with ANSI/AWWA C203. The casing shall be shop cut with ends square with centerline, leveled and welded so that the entire length of the casing shall be straight and true.

B. Field and shop welds of the casing pipes shall conform with American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4-inch, nor shall there be intrusion of the weld metal into the bore of the casing.

2.2 JOINTS

Joints shall be butt welded in accordance with the requirements of ANSI/AWWA C206. The joints shall be welded with a continuous circumferential weld. It shall be the Contractor's responsibility to provide stress transfer across the joints which is capable of resisting the jacking forces involved.

2.3 CARRIER PIPE

The carrier pipe material shall be in accordance with the Construction Drawings and specifications and will be restrained with manufacturer's restrained joints.

3.0 EXECUTION

3.1 GENERAL

The installation of pipeline casings under the railroad or highway as shown on the Construction Drawings shall be in accordance with all the requirements of the railway company, the Florida Department of Transportation, Suwannee County, or other governing regulatory agency.

3.2 EXCAVATION

A. A two-inch auger pilot hole shall first be attempted to determine if rock will prevent the installation of the casing. If the pilot hole is successfully made, the casing shall be installed.

B. The leading section of casing shall be equipped with a jacking head securely anchored thereto to prevent any wobble or variation in alignment during the jacking operation.

C. Excavation shall be performed entirely within the jacking head and no excavation in advance thereof shall be permitted. Every effort shall be made to avoid any loss of earth outside the jacking head.

D. Excavated material shall be removed from the casing as excavation progresses, and no accumulation of such material within the casing will be permitted.

3.3 BORING AND JACKING

A. The boring and jacking operations shall be done simultaneously with correct line and grade carefully maintained for the casing. Holes for casing shall be bored with an auger mounted inside the pipe with the auger extending a short distance beyond the lead end of the pipe to preclude caving.

B. Excavation for jacking pits or shafts shall be in accordance with applicable sections of these specifications.

C. Carrier pipes shall have manufacturer's restrained joints and shall be supported to prevent damages to either carrier pipe or casing pipe. The ends of the casing pipe shall be sealed with brick and mortar after installation of the utility pipe or other approved method.

D. The top of the casing shall maintain a minimum of 36-inch clearance under the roadway surface or as indicated on the Construction Drawings.

E. The invert elevation of the steel casing for the individual roadway crossings shall be set in the field by the Contractor and shall be based on the minimum vertical clearance between the top of the carrier pipe, unless otherwise indicated on the Construction Drawings, and the existing utilities on either side of the crossing site unless otherwise noted on the Construction Drawings.

F. Casing invert elevations which are proposed by the Contractor are subject to approval.

3.4 GROUTING

After jacking is completed, the Contractor shall drill holes in the casing at the locations of ground loss and elsewhere where voids are suspected and shall force grout in to fill voids to refusal at satisfactory pressures, but not to exceed 50 psi. This shall be done only in casings with large enough diameter to provide adequate working room.

3.5 LOSS OF GROUND

A. Should appreciable loss of ground occur during the jacking operation, the voids shall be backpacked promptly to the extent practicable with soil cement consisting of a slightly moistened mixture of 1 part cement to 5 parts granular material. Where the soil is not suitable for this purpose, the Contractor shall provide suitable material at his expense.

B. The soil cement shall be thoroughly mixed and rammed into place as soon as possible after the loss of ground.

3.6 TOLERANCES

Extreme care shall be exercised by the Contractor to maintain line and grade during jacking operation, and the Contractor may be required to modify the manner in which he is conducting his jacking operation to correct any deviation when deemed necessary by the County Project Manager, or Inspector.

3.7 RESPONSIBILITY

The Contractor shall be fully responsible for the placement of the casing. The details shown on the Construction Drawings are to be considered minimum only.

3.8 INSTALLATION OF PIPE

A. The pipe shall be installed in the casing using approved manufactured casing spacer centered on pipe length.

B. The pressure of sliding carrier pipe into the casing shall not be applied directly to carrier pipe. A plank, timber, or other material acceptable to the Project Manager shall be placed over the pipe end, during pushing, to protect it from damage.

C. Adjust the pipe grade as required by changing the thickness of the spacers to compensate for any grade variations of the casing.

D. If the alignment of the casing is such that the pipe grade cannot be met, the grade of the pipe shall be adjusted, if required by the Project Manager or Inspector. If realignment is not deemed feasible, another casing meeting the required grade shall be installed. The abandoned casing shall be filled with sand and the ends plugged with 12-inch thick masonry plugs. Realignment or replacement work shall in no way result in extra cost to the County.

E. Ends of casing pipe shall be sealed with brick and mortar after installation of the carrier pipe. Seal thickness shall be a minimum 4 inches or as specified on contract drawings. Elastomeric end seals fastened with stainless steel bands shall be installed at each end of casing.

3.9 INSURANCE REQUIREMENTS AND FEES

A. With respect to the railway line crossings, the Contractor shall provide insurance in accordance with the railroad company requirements.

B. All work performed within the State of Florida Department of Transportation rights-of-way or within the Railroad property limits shall be in accordance with the requirements of those agencies which are hereby made a part of these specifications. It is the responsibility of the Contractor to determine all requirements of these agencies and to comply with said requirements including any necessary bonds, cash deposit, or insurance.

C. The Contractor will not be permitted to commence work on the railroad or highway crossing until bonds, cash deposits, or insurance furnished pursuant to the above by the Contractor is to the satisfaction of the railroad company or Florida Department of Transportation.

3.10 SUCCESSFUL COMPLETION

A. The Contractor shall be considered as having completed the requirements of any one boring or jacking when he has successfully completed the work to the satisfaction of the Engineer of Record.

B. The locations of any second or third attempts shall have the concurrence of the County Project Manager, or Inspector. If, after three attempts, the Contractor is not able to complete a boring or jacking, he may request authorization to use a trench. If such authorization is granted, the installation of the pipe and restoration of the surface shall be at no additional cost except that the Contractor shall be reimbursed for any casing abandoned in place at the unit price set forth in the Unit Price Schedule for Change Orders. If such authorization is not granted and the Contractor is required to utilize other methods approved by Water Resource Services, it shall be considered additional work. However, appropriate credit shall be given for not having performed the borings or trenching.

END OF SPECIFICATION

SECTION 02090

SUBSURFACE INVESTIGATION AND SOIL BORINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Subsurface hydrogeological data are presented in the report titled "Geological Investigation Report/Groundwater Monitoring Plan for South Columbia County Regional Wastewater Treatment Plant Spreadfield Site by Jim Stidham and Associates, Inc. dated October 2008. A copy of the complete soils report will be available on request.
- B. The subsurface information was only obtained for design purposes and may not be an adequate representation of actual conditions for project construction. Information shown, including water levels, represents existing conditions at the specific boring locations at the time the borings were made. All risks resulting from use or interpretation of the subsurface data shown shall be borne by the Contractor.
- C. In determining the quantity of fill, the Contractor shall remove all unsuitable soil that is directly under a structure or within 10 feet (measured horizontally) of the outside of any structure. Unsuitable soil removal shall not be required for proposed stormwater pond areas so long as the 10 foot requirement for structures and the depth requirement for the stormwater ponds can be met.

All earthwork activities required for this project shall be included in the lump sum price for the Contract. As noted in parentheses in the bullet items below, there is NOT a separate pay item for the following construction activities:

- Common excavation/fill (shall be included in lump sum price)
 - Muck removal and disposal (shall be included in lump sum price)
 - Grading (shall be included in lump sum price)
 - Excavation and fill required to meet the finished elevations on the site (shall be included in lump sum price)
- D. If additional subsurface information is required by the Bidder/Contractor it shall be the Bidder's/Contractor's responsibility to obtain such data.
 - E. Refer to the General Conditions for further explanation of subsurface conditions.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section covers clearing, grubbing and stripping along the construction sites, complete as specified herein.
- B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes but is not limited to, utility easements. The width of the area to be cleared shall be established by the Engineer prior to the beginning of any clearing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CLEARING

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

3.02 GRUBBING

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

3.03 STRIPPING

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

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris away to an approved disposal site. Disposal by burial will be permitted if all material is first chipped and thoroughly processed. 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 contract price.

3.05 PRESERVATION OF TREES

- A. Those trees which are designated for preservation shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary for the protection of the trees during all construction operations.
- B. The existing trees on the plant site shall be protected from damage by the Contractor. The only trees to be removed are the Brazilian Pepper Trees, if encountered, in the existing plant perimeter buffer area. The Contractor shall be responsible for removal and disposal of tree stumps in the area to be cleared for construction.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property. Trees, shrubbery, gardens, lawn and other landscaping, which in the opinion of the Engineer must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preparation procedures and replanting operations shall be under the supervision of a nurseryman experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, etc., 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 from developed private property directly after construction is completed upon approval of the Engineer.

3.07 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Articles 3.05 and 3.06 of these specifications shall apply to the preservation and restoration of all damaged areas of public lands, parks, rights-of-way, easements, etc.

END OF SECTION

SECTION 02110

CLEARING, GRUBBING, AND STRIPPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section describes the work included in clearing, grubbing, stripping, and otherwise preparing the project site for construction operations.
- B. Related Work Specified Elsewhere:
 - 1. Excavation, Backfilling, and Compaction: Section 02220.
- C. Definitions:
 - 1. Clearing: Remove and dispose of shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches. Remove and dispose of trash piles and rubbish that currently is scattered over the construction site or collects there during construction. Protect trees, shrubs, vegetative growth, and fencing which are not designed for removal. 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 safety of employees and others.
 - 2. 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 remaining after clearing 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. Stripping: Remove and dispose of all organics and sod, topsoil, grass, and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. Grass, grass roots and organic material in areas to be excavated or filled shall be stripped to the depth as noted in the soils report. In areas so designated, topsoil shall be stockpiled. Strippings and unsuitable material, such as organic material, shall be disposed of by the Contractor unless directed otherwise by the Engineer.

PART 2 - MATERIALS

2.01 GENERAL

- A. Trees and Shrubbery: Existing trees, shrubbery, and other vegetative material may not be shown on the Drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve, in place, trees that are specifically shown on the Drawings and designated to be preserved.
- B. Preservation of Trees, Shrubs, and Other Plant Material:
 - 1. All plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing shall be saved and protected from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
 - 2. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, the trunks of all trees 2 inches or greater in diameter shall be protected by encircling the trunk entirely with boards held securely by 12-gauge wire and staples. This protection shall extend from ground level to a height of 6 feet. Cut and remove tree branches where such cutting is necessary to affect construction operation. Remove branches other than those required to affect the work to provide a balanced appearance of any tree. Scars resulting from the removal of branches shall be treated with a tree sealant.

PART 3 - EXECUTION

3.01 GENERAL

- A. Clearing and Grubbing Limits: All excavation areas associated with new structures, slabs, and roadways shall be cleared and grubbed to the following depths:
 - 1. Roadway and Paved Area: 2 feet below existing grade and replace with compacted backfill.
 - 2. Proposed Structures: 3 feet below existing grade within a 10 foot margin of each structure and replaced with compacted backfill as shown on the plans.

3. Building Site Areas not specifically noted above: 2 feet below existing grade and replaced with compacted backfill as specified herein.
 4. All other areas: 2 feet below completed surface.
- B. Disposal of Clearing and Grubbing Debris: Do not burn combustible materials. Remove all cleared and grubbed material from the work site and dispose of in accordance with all local laws, codes, and ordinances.
- C. Areas to be Stripped: All excavation and embankment areas associated with new structures, slabs, walks, and roadways shall be stripped. Stockpile areas shall be stripped.
- D. Disposal of Strippings: Remove all stripped material and dispose off-site, unless otherwise directed to stockpile material.

END OF SECTION

SECTION 02140

DEWATERING

PART 1-GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work to be performed under this section shall include the design and installation of a temporary dewatering system until completion of construction to remove subsurface waters from structure or utility trench excavations as required.

1.02 QUALITY ASSURANCE

- A. Qualifications: The temporary dewatering system shall be designed by a firm who regularly engages in the design of dewatering systems and who is fully experienced, reputable and qualified in the design of such dewatering systems. The firm shall have a successful record of operation for a minimum of five (5) years prior to bid date. The design firm shall supply the Engineer with previous installation details of at least three (3) successful dewatering operations of a similar nature in the State of Florida.
- B. In lieu of experience, the Contractor shall provide a performance and warranty bond for 1.0 times the total installed cost of the temporary dewatering system. This bond shall be executed prior to award and/or contract execution.
- C. Standards: The dewatering of any excavation areas and the disposal of water during construction shall be in strict accordance with all local and state government rules and regulations. If a consumptive use permit is required by local Water Management District, the Contractor shall be responsible for obtaining said permit.

1.03 SUBMITTALS

- A. Submit to the Engineer for review, the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction, and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.
- B. Submittals shall be in accordance with Section 01340, and shall include the following:
 - 1. Design Notes and Drawings.

2. Descriptive literature of the temporary dewatering system.
3. Layout of all piping involved.
4. Observation well locations.

1.4 CRITERIA

- A. The dewatering system shall be developed to the point that is capable of dewatering the site surrounding all structures or utility trenches as shown on the Drawings. Each wellpoint system shall be capable of dewatering and maintaining groundwater levels at the respective excavations. Observation wells shall be constructed for the purpose of testing each system.
- B. Observation Wells:
 1. Prior to excavation, the Contractor shall install groundwater observation wells at locations as directed by the Contractor's Geotechnical Engineer and as approved by the Engineer adjacent to structures under construction for the purpose of measuring water levels during excavations. The observation well shall consist of screen, casing and cap of approved size and material of construction. The observation well shall be placed in a 2 1/2-inch bore hole which shall be carried to an elevation at least to final bottom grade of structure. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to ensure proper indication of subsurface water levels adjacent to the well.
 2. The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater in them until adjacent structure of utilities are completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the Engineer. The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well, recording the drop in the level from the time the water was added. Any plugged observation well shall be redeveloped if necessary to indicate true groundwater levels.
 3. Observation wells shall be abandoned when directed by the Engineer, and in a manner acceptable to the Engineer.

1.05 PUMPING AND DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures 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 levels. The Contractor shall submit to the Engineer, for review, a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with overall construction plan, and certification of this shall be provided by a Geotechnical Engineer. The Geotechnical Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
- B. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. As a minimum, the water level shall be two (2) feet below the trench bottom. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding soils.
- C. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
- D. The Contractor shall take all additional necessary precautions and prevent uplift of any structure during construction.
- E. The conveying of water other than stormwater surface runoff in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the controlling authority. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and the Contractor shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored at no cost to the Owner.
- F. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
- G. Removal of dewatering equipment shall be accomplished after the Contractor and the Engineer agree that the system is no longer required; the material and

equipment constituting the system, shall be removed by the Contractor.

- H. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, or other contaminants in order to prevent adverse effects on groundwater or receiving water quality.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The equipment specified herein shall be standard dewatering equipment of proven ability as designed, manufactured, and installed by firms having experience in the design and production of such equipment. The equipment furnished shall be designed, constructed and installed in accordance with the best practices and methods.
- B. The Contractor shall engage a Geotechnical Engineer registered in the State of Florida, to design the temporary dewatering system for all structures. The Contractor shall submit a conceptual plan for the dewatering system prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan and certification of this shall be provided by the Geotechnical Engineer. The Geotechnical Engineer shall be required to monitor the performance of the dewatering system at the Contractor's expense during the progress of the work and require such modifications as may be required to assure that the systems will perform satisfactorily. Dewatering system shall be designed in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the proposed structures or utilities and to preserve the integrity of any adjacent structures.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Dewatering: The Contractor shall install a temporary dewatering system for the removal of subsurface water encountered during construction of the proposed structures or utilities.
- B. Consumptive Use Permit (CUP): If pumping requirements exceed certain limits, the Contractor shall pay for and obtain a CUP from the local water management district for such pumped volumes.

3.02 PROTECTION AND SITE CLEAN-UP

- A. At all times during the progress of the work the Contractor shall use all reasonable

precautions to prevent either tampering with the wellpoints (if used) or the entrance of foreign material into the site's storm drain system.

- B. Immediately upon completion of the dewatering operations, the Contractor shall remove all of his equipment, materials, and supplies from the site of the work, remove all surplus materials and debris, fill in all holes or excavations, and grade the site to elevations of the surface levels which existed before the work started. The site shall be thoroughly cleaned and graded as directed by the Engineer.

END OF SECTION

SECTION 02160

STABILIZING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Stabilize designated portions of the roadbed to provide a firm and unyielding subgrade, having the required bearing value specified in the plans. When specified in the plans, provide additional strengthening of the subbase by additional stabilizing of the upper portion of the previously stabilized subgrade, within the limits specified.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Commercial Materials

1. Materials may be either limerock, shell rock, cemented coquina or shell base sources approved by the Owner.
2. Specific Requirements for Limerock: For limerock, carbonates of calcium and magnesium shall be at least 70%. Materials having a plasticity index of more than ten or a liquid limit greater than 40 shall not be used as a stabilizer. The gradation of limerock shall be such that 97% of these materials will pass a 3 1/2 inch sieve.
3. Crushed Shell: Crushed shell for this use shall be mollusk shell (i.e., oysters, mussels, clams, cemented coquina). Steamed shell will not be permitted. This shell shall meet the following requirements:
 - a. Material having a plasticity index of more than ten or a liquid limit greater than 40 shall not be used as a stabilizer.
 - b. At least 97% by weight of the total material shall pass a 3 1/2 inch sieve and at least 50% by weight of the total material shall be retained on the No. 4 sieve.
 - c. Not more than 20% by weight of the total material shall pass the No. 200 sieve. The determination of the percentage passing the No. 200 sieve shall be per FM 1-T 011.

d. In the event that the shell meets the above requirements without crushing, crushing will not be required.

B. Local Materials

1. Local materials used for this stabilizing may be soils or recyclable materials such as crushed concrete, roof tiles and asphalt coated base or reclaimed pavement. However, no materials that deteriorate over time, cause excessive deformations, contain hazardous substances, contaminants, or do not improve the bearing capacity of the stabilized material may be used. The Contractor shall provide information to substantiate these properties. At least 97% by weight of the total material shall pass a 3 1/2 inch sieve. Material having a plasticity index greater than ten or a liquid limit greater than 40 shall not be used as a stabilizer.
2. No blending of materials to meet these requirements will be permitted unless authorized by the Engineer. When blending is permitted blended material shall be tested to ensure the above requirements are met before being spread on the roadway.

C. Testing of Materials for Use as Stabilizer

1. No testing of any materials proposed to be furnished by the Contractor will be made by the Owner prior to the determination of the successful bidder, and the bidder shall make his own arrangements for the preliminary determination of the suitability of the particular material he proposes to use.
2. For evaluation of deterioration and excessive deformation, each material source shall not have an average organic content (minimum of three tests) greater than 2.5% and any individual test value more than 4.0%. The organic content shall be performed in accordance with AASHTO T 267. If toxic substances, elements or compounds are suspected at concentrations defined by EPA, qualifying tests shall be performed. Test methods for these substances shall be those mandated by EPA and analyzed by a certified laboratory.
3. All test results of the proposed stabilizing material shall be submitted to the Engineer for approval at least 14 days prior to commencement of the field stabilizing operation. The Engineer may request samples of the stabilizing material and subgrade soil for verification tests.

PART 3 - EXECUTION

3.01 – GENERAL

- A. Prior to the beginning of stabilizing operations, construct the area to be stabilized to an elevation such that, upon completion of stabilizing operations, the completed stabilized subgrade will conform to the lines, grades, and cross-section shown in the plans. Prior to spreading any additive stabilizing material, bring the surface of the roadbed to a plane approximately parallel to the plane of the proposed finished surface.
- B. After substantially completing the roadbed grading operations, determine the type and quantity (if any) of stabilizing material necessary for compliance with the bearing value requirements.
- C. The Contractor may process the subgrade to be stabilized in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction, and other desired results, in which case, the Engineer will direct that the processing be done in more than one course.
- D. Determine compliance with the bearing value requirements by testing in accordance with FM 5-515. Take responsibility for making the finished roadbed section meet the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. The Owner will make full payment for any areas where the existing subgrade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Contractor may elect to place select high-bearing materials from other sources within the limits of the stabilizing.

3.02 APPLICATION OF STABILIZING MATERIAL

- A. When additive stabilizing materials are required, spread the designated quantity uniformly over the area to be stabilized.
- B. Spread commercial stabilizing material by the use of mechanical material spreaders, except that where use of such equipment is not practicable, use other means of spreading, but only upon written approval of the proposed alternate method.

3.03 MIXING

- A. Perform mixing using rotary tillers or other equipment meeting the approval of the Engineer. The Contractor may mix the materials in a plant of an approved type suitable for this work. Thoroughly mix the area to be stabilized throughout the entire depth and width of the stabilizing limits.

- B. Perform the mixing operations, as specified, (either in place or in a plant) regardless of whether the existing soil, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.
- C. At the completion of the mixing, ensure that the gradation of the material within the limits of the area being stabilized is such that 97% will pass a 3 1/2 inch sieve and that the material does not have a plasticity index greater than eight or liquid limit greater than 30. Remove any materials not meeting the plasticity requirements from the stabilized area. The Contractor may break down or remove from the stabilized area materials, including clay lumps or lumps made of clay-size particles (any particle size 2 microns or less), not meeting the gradation requirements.

3.04 COMPACTION

- A. After completing the mixing operations and satisfying the requirements for bearing value, uniformity, and particle size. Compact the materials at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either add water or allow the material to dry until reaching the proper moisture content for the specified compaction.

3.05 FINISH GRADING

- A. Shape the completed stabilized subgrade to conform with the finished lines, grades, and cross-section indicated in the plans. Check the subgrade using elevation stakes or other means approved by the Engineer.

3.06 REQUIREMENTS FOR CONDITION OF COMPLETED SUBGRADE

- A. After completing the stabilizing and compacting operations, ensure that the subgrade is firm and substantially unyielding to the extent that it will support construction equipment and will have the bearing value required by the plans.
- B. Remove all soft and yielding material, and any other portions of the subgrade which will not compact readily, and replace it with suitable material so that the whole subgrade is brought to line and grade, with proper allowance for subsequent compaction.

3.07 MAINTENANCE OF COMPLETED SUBGRADE

- A. After completing the subgrade as specified above, maintain it free from ruts, depressions, and any damage resulting from the hauling or handling of materials, equipment, tools, etc. The Contractor is responsible for maintaining the required density until the subsequent base or pavement is in place including any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Perform any such recompaction at no expense to the Owner. Construct and maintain ditches and drains along the completed subgrade section.

3.08 ACCEPTANCE PROGRAM

- A. Acceptance Criteria:
1. Bearing Value Requirements: Within the entire limits of the width and depth of the areas to be stabilized, obtain the required minimum bearing value. For any area where the bearing value obtained is deficient from the value indicated in the plans, in excess of the tolerances established herein, spread and mix additional stabilizing material. Perform this reprocessing for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing value is deficient.
 2. Mixing Depth Requirements: Do not exceed individual plan depth thickness by more than 2 inches
 3. Density Requirements: Within the entire limits of the width and depth of the areas to be stabilized, obtain a minimum density at any location of 95% of the Modified Proctor maximum density as determined by FM 1-T 180, Method D.
 4. Frequency: Conduct testing at a minimum frequency listed in the table below.

Test Name		Frequency
Modified Proctor		One per 1000 feet
Maximum Density		
Density		One per 500 feet
Stabilizing	Mixing	Three per 500 feet
Depth		
Limerock	Bearing	One per 1000 feet
Ratio		

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section includes materials, testing, and earthwork for excavations, fills, and embankments.
- B. Related Work Specified Elsewhere:
 - 1. Excavation, Backfilling and Compaction: Section 02220.
 - 2. Cast-In-Place Concrete: Section 03300.

1.02 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with the Section 01340: Shop Drawings, Working Drawings and Samples.
- B. Submit six (6) copies of a report from a testing laboratory verifying that any off-site borrow material conforms to the gradation specified.

1.03 TESTING REQUIREMENTS

- A. Determination of laboratory moisture-density relationship and maximum density shall be by the Modified Proctor Method of ASTM D-1557. At least one (1) test per soil type shall be made.
- B. In place soil density shall be determined either by use of a Nuclear Density Meter per ASTM D-2922 or by use of the Drive Sleeve Method per ASTM D-2937. In place field densities shall be taken at one (1) every 5,000 square feet and at not greater than 1 foot vertical intervals for all fill areas under structures and pavement. One (1) density test is required for each pad or isolated footing and for every 20 linear feet of strip/wall footing length.
- C. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.
- D. Relative compaction is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.

- E. Density tests will be made for determination of specified compaction by an independent testing laboratory provided by the Contractor as approved by the Engineer. Tests will be made in locations reviewed and approved by the Engineer. If any tests are unsatisfactory, re-excavate and recompact the fill or backfill until the desired compaction is obtained. Additional compaction tests will be taken to each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and recompaction necessary.

PART 2 - PRODUCTS

2.01 FILL AND BACKFILL

- A. Fill and backfill shall be clean, granular sand that is free from organic matter, roots, debris, and rocks larger than three inches in the greatest dimension and having less than 10 percent (10%) passing the No. 200 U.S. sieve size.
- B. Water for Compaction: Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l. Provide all water needed for earthwork. Provide temporary piping and valves to convey water from the source to the point of use. Provide any meters if the water is taken from a water district or agency pipeline.

PART 3 - EXECUTION

3.01 COMPACTION REQUIREMENTS

- A. Unless otherwise specified or shown on the Drawings, compact fill, embankments, and backfills to 95 percent (95%) Modified Proctor Density.
- B. Excavation is unclassified. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction.
- C. Placing and Compacting Fill Material:
 - 1. Excavated material which conforms to the specifications may be used for fill or backfill.
 - 2. Place all materials at optimum moisture content.
 - 3. Compact each lift to the extent specified.
- D. Foundation Requirements:
 - 1. All structure foundation bottoms shall be recompacted and retested after excavation to densify soils loosened in the excavation process.

2. Soils placed adjacent to footings or walls shall be carefully compacted to avoid damaging the footing or wall. Approved structural sand fills placed in footing excavations above the bearing level, in trench of pipeline excavations within the structure area plus 10 feet beyond the perimeter walls, and in other areas which are expected to provide slab support and/or foundation embedment constraint shall be placed in loose lifts not exceeding 6 inches.
- E. Moisture Control of Earth Material: During the compaction operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the material. Maintain moisture content uniform throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.
- F. Site Grading:
1. Perform earthwork to the lines and grades shown on the Drawings. Shape, trim and finish slopes to conform with the lines, grades and cross-sections as shown on the Drawings. Make slopes free of exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves to not less than a 6 foot radius.
 2. Neatly and smoothly trim rounded surfaces. Do not over-excavate and backfill to achieve the proper grade.
 3. Final grades shall be within 0.1 foot of the required elevation.
- G. Disposal of Excess Excavation: Dispose of excess excavated suitable materials at designated on-site soil areas indicated on the Drawings or directed by the Engineer. If on-site disposal is not indicated or directed by the Engineer, dispose of excess excavated materials off-site. Contractor shall make his own arrangements for the disposal of all excess suitable or unsuitable material and bear all costs incidental to such disposal.

END OF SECTION

SECTION 02210

SITE GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work in this section consists of furnishing all necessary labor, equipment, material necessary to bring the project site to the lines and grades shown on the Drawings.
- B. The Contractor must determine for himself the volume of material required for the site.
- C. Definitions:
 - 1. Open Areas: Open areas shall be those areas that do not include building sites, limerock areas, access road right-of-way and parking areas.
 - 2. Maximum Density: Maximum weight in pounds per cubic foot (pcf) of a specific material.
 - 3. Optimum Moisture: Percentage of water in a specific material at maximum density.
 - 4. Rock Excavation: Excavation of any hard natural substance which requires the use of special impact tools such as, jackhammers, sledges, chisels, or other similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
- D. Related Work Described Elsewhere:
 - 1. Excavation, Backfilling and Compaction: Section 02220.

1.02 SUBMITTALS

- A. Submit six (6) copies of a report from a testing laboratory verifying that off-site borrow material conforms to the gradation specified.

1.03 TESTING REQUIREMENTS

- A. Determination of laboratory moisture-density relationship and maximum density shall be by the Modified Proctor Method of ASTM D-1557. At least one (1) test per soil type shall be made.
- B. In place soil density shall be determined either by use of a Nuclear Density Meter per ASTM D-2922 or by use of the Drive Sleeve Method per ASTM D-2937. In place densities shall be taken at one (1) every 5,000 square feet at not greater than 1 foot vertical intervals for all areas of potential building or pavement construction. One (1) density test is required for each pad or isolated footing and for every 20 lined feet of strip/wall footing length.
- C. Compaction shall be deemed to comply with the Specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the Specifications.
- D. Relative compaction is defined as the ratio, expressed as a percentage, of the in-place density to the laboratory maximum density.
- E. Density tests will be made for determination of specified compaction by an independent testing laboratory provided by the Contractor as approved by the Engineer. Tests will be made in locations reviewed and approved by the Engineer. If any tests are unsatisfactory, re-excavate and recompact the fill or backfill until the specified compaction is obtained. Additional compaction tests will be taken to each side of an unsatisfactory test at locations approved by the Engineer to determine the extent of re-excavation and recompaction necessary.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Suitable: Suitable materials for fills shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145 and shall be free from vegetation and organic material. Not more than 10 percent (10%) by weight of fill material shall pass the No. 200 sieve. The Contractor shall furnish all additional fill material required.
- B. Suitable Material To Be Placed In Water: Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance with AASHTO Designation M-145.
- C. Unsuitable: Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7 and A-8 in accordance with AASHTO Designation M-145.

- D. Water for Compaction: Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/l, and a maximum sulfate concentration of 500 mg/l. Provide all water needed for earthwork. Provide temporary piping and valves to convey water from the source to the point of use. Provide any meters if the water is taken from a water district or agency pipeline.

PART 3 - EXECUTION

3.01 PERFORMANCE

- A. Unless otherwise specified or shown on the Drawings, compact fill, embankments, and backfills to 95 percent (95%) Modified Proctor Density.
- B. Excavation:
1. Excavation shall conform to the limits indicated on the plans or specified herein. This work shall include shaping and sloping and other work necessary in bringing the earthwork to the required grade, alignment and cross section.
 2. All suitable materials removed from the excavation shall be used as far as practicable in the formation of the embankments, subgrades, shoulders, building sites and other places as directed. No excavated material shall be wasted without permission, and where necessary to waste much material it shall be at the direction of the Engineer. Unsuitable material shall be removed to the required depth and replaced to the satisfaction of the Engineer with suitable material. Unsuitable material existing in open areas may remain, and these open areas may be used for disposal areas for the unsuitable material as directed by the Engineer.
- C. Fills:
1. Fills shall be formed of suitable material placed in layers of not more than 8 inches in depth measured loose and rolled and/or vibrated with suitable equipment until compacted. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Layer thickness shall be decreased if equipment and methods used are proven to be incapable of compacting the layers to specified densities.
 2. Rock that will not pass through a 6 inch diameter ring shall not be placed within the top 12 inches of the surface of the completed fill. Rock that will not pass through a 3 inch diameter ring shall not be placed within the top 4 inches of the completed fill. Broken concrete or asphaltic pavement shall not be used in fills.

3. Muck or other unsuitable material may be used in areas designated in the drawings or as directed by the Engineer. Muck material used as fill shall be placed in layers of not more than 12 inches in depth measured loose. When dry or as directed by the Engineer, this layer shall be disced and harrowed to break up large pieces of the material placed.
 4. Final elevations shall be within 0.1 foot of the required elevation and surfaces shall be sloped to drain as shown on the Drawings.
- D. Excess excavation of suitable materials shall become, unless otherwise noted, the property of the Owner and shall be disposed of on-site at an area to be determined by the Owner. The Owner may elect to not keep the material in which case the Contractor shall make arrangements and bear all cost of disposing the material off-site. All unsuitable excess material shall be disposed off-site by the Contractor.
- E. Moisture Control of Earth Material: During the compaction operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the material. Maintain moisture content uniform throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

END OF SECTION

SECTION 02220

EXCAVATION, TRENCHING BACKFILLING, AND COMPACTION

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included under this Section consists of dewatering, excavating, trenching, sheeting/shoring, grading, backfilling, and compacting those soil materials required for the construction of the structures, piping, ditches, utility structures and appurtenances as shown on the Drawings and specified herein.
- B. Definitions:
 - 1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
 - 2. Optimum Moisture Content: The optimum moisture content shall be determined by ASTM D 1557 specified to determine the maximum dry density for relative compaction. Field moisture content shall be determined on the basis of the fraction passing the 3/4-inch sieve.
 - 3. Rock Excavation: Excavation of any hard natural substance which requires the use of special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
 - 4. Suitable: Suitable materials for fills shall be classified as A-1, A-3 or A-2-4 in accordance with AASHTO Designation M-145 and shall be free from vegetation, organic material, marl, silt or muck. Not more than 10 percent (%) by weight of fill material shall pass the No. 200 Sieve. The Contractor shall furnish all additional fill material required.
 - 5. Unsuitable: Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, and A-B in accordance with AASHTO Designation M-145.
- C. Plan for Earthwork:
 - 1. The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions,

the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract according to the General Conditions.

2. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations to the Engineer for review. The Contractor shall reflect the equipment and methods to be employed in the excavation. Prices established in the Proposal for the work to be done will reflect all costs pertaining to the work. No claims for extras based on substrata or groundwater table conditions will be allowed.

- D. Trench Safety Act: The Contractor shall comply with all of the requirements of the Florida Trench Safety Act (Chapter 90-96, CS/CB 2626, Laws of Florida). The Contractor shall acknowledge that included in various items of his bid proposal and in the total bid price are costs for complying with the provisions of the Act. Failure to comply with the provisions of the Act shall result in a per item penalty of \$1,000 per day that the work is out of compliance.

1.02 APPLICABLE PUBLICATIONS

- A. All publications and standard specifications referred to herein are the latest or current issue of that publication or specification as of the specification date.

1.03 QUALITY ASSURANCE

- A. The requirements for testing and laboratory services is specified in Section 01410: Testing and Testing Laboratory Services.

1.04 FEDERAL AND STATE REGULATORY REQUIREMENTS

- A. All trench excavations which exceed 4 feet in depth shall comply with the applicable trench safety standards as stated in the OSHA excavation safety standards 29 CFR S. 1926.650 Subpart P as regulated and administered by the Florida Department of Labor and Employment Security as the "Florida Trench Safety Act."

1.05 JOB CONDITIONS

- A. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the footing elevation, or in the depth of removal of unsuitable material from that indicated in the soils report, an adjustment will be made in the contract price, as provided in the General and Special Conditions.

1.06 PROTECTION

- A. Pre-Construction Survey:

1. Prior to commencing excavation, backfill or dewatering, the Engineer and Contractor shall jointly conduct a survey of those existing structures which, in the opinion of the Engineer, may be subject to settlement or distress resulting from excavation or dewatering operations.
2. The Engineer will monitor the structures surveyed to ascertain evidence of settlement or distress. If settlement or distress becomes evident, the Contractor shall be required to repair the structures to the previous condition to the satisfaction of the Engineer. Costs shall be paid by the Contractor.

1.07 SUBMITTALS

- A. Submit to the Engineer for review the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction and backfilling for the various portions of the work. Review shall be for method only. The Contractor shall remain responsible for the adequacy and safety of the methods.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material from on and off-site sources shall be subject to the approval of the Engineer.
2. All fill material shall be unfrozen and free of organic material, trash, or other objectionable material. Excess or unsuitable material as designated by the Engineer shall be removed from the job site by the Contractor.

B. Common Fill Material:

1. Common fill shall be sand not containing stones, rock, concrete or other rubble larger than 2 inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.
2. The Contractor shall utilize as much excavated material as possible for reuse in accordance with the contract drawings and specifications or as directed by the Engineer.
3. The Engineer shall direct the Contractor on the type of material allowed in certain sections of the earthwork operations.

- C. Structural Fill: Structural fill shall be well-graded sand to gravelly sand having the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1 - inch	100
No. 4	75-100
No. 40	15-80
No. 100	0-30
No. 200	0-10

- D. Class I Soils¹ : Manufactured angular, granular material, 1/4 to 1-1/2 inches (6 to 40 mm) in size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

1. Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0-5

- E. Class II Soils² :

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

¹ Soils defined as Class I soils are not defined in ASTM D2487.

² In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
- F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:
- | <u>U.S. Sieve Size</u> | <u>Percent Passing By Weight</u> |
|------------------------|----------------------------------|
| No. 10 | 100 |
| No. 20 | 0-30 |
| No. 40 | 0-5 |
- G. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clearing and Grubbing:
1. Clearing and grubbing shall be performed in accordance with Section 02100.
 2. Strip and dispose of topsoil off-site, unless otherwise directed to stockpile the material by the Engineer

3.02 PROTECTION

- A. Sheeting and Bracing:
1. Furnish, put in place, and maintain sheeting and bracing as required to support the sides of excavations, to prevent movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Owner is of the opinion that sufficient or proper supports have not been provided, he may order additional supports be installed at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids beside the sheeting, but if voids are formed, they shall be immediately filled and

compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.

2. The Contractor shall construct sheeting outside the neat lines of the foundation unless deemed otherwise for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall withstand all pressure to which the structure or trench will be subjected. Any deformation shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
3. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall conform with the design, and certification of this shall be provided by the Professional Geotechnical Engineer.
4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.
5. The Contractor shall leave in place to be embedded in the backfill, all sheeting and bracing not shown on the Drawings but which the Owner directs him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Owner may direct that timber used for sheeting and bracing be cut off at any specified elevation.
6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction, or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted for that purpose, or otherwise directed by the Owner.
7. The right of the Owner to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures 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 levels as stipulated in Section 02140. The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The installed dewatering system shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Geotechnical Engineer. The Professional Geotechnical Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent intermixing of finer grained soil from the surrounding ground.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent buoyant uplift of any structure during construction.
5. The conveying of dewatered liquids in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. The Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to

facilities shall be repaired or restored as directed by the Owner or the authority having jurisdiction, at no cost to the Owner.

6. Flotation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system shall be removed by the Contractor.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

3.03 EXCAVATION

A. Excavating for Structures and Utilities:

1. Excavation work shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.
2. Excavation shall be made to such dimensions as will give suitable room for bracing and supporting, for pumping and draining, for installing the pipelines, and for all other work required.
 - a. Excavation for precast or prefabricated structures shall be carried to an elevation two (2) feet lower than the proposed outside bottom of the structure to provide space for the backfill material.
 - b. Excavation for structures constructed or cast-in-place in dewatered or dry excavations shall be carried down to the 3-feet below the bottom of the structure where dewatering methods are such that a dry evacuation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with crushed stone.
3. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.

4. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.
5. Encounters with subsurface obstructions shall be hand excavated.
6. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Engineer at the Contractor's expense.
7. The bottom of excavations shall be rendered firm and dry before placing any structure or pipe. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor in a legal manner. The bedding schedule for pipes shall be as shown in Table 02220-B.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
9. All structure and pipe locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's approval of the Application for Payment for that work.

3.04 DRAINAGE

- A. 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 excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.
- B. All water pumped or drained from the excavated area shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.
- C. No construction, including pipe laying, shall be allowed in water. Groundwater shall be maintained at least 12 inches below excavation. No water shall be allowed to come into contact with masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

- D. The Contractor will be required at his expense to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

3.05 UNDERCUT

- A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be as directed by the Engineer.

3.06 STABILIZATION

- A. Subgrades for concrete structures and trench bottoms shall be firm dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact.
- B. Subgrades for concrete structures or trench bottoms which are otherwise solid, but which becomes mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. Not more than 1/2 inch depth of mud or muck shall be allowed to remain on stabilized trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations shown on the Drawings.
- C. All stabilization work shall be performed by and at the expense of the Contractor.

3.07 FILL AND COMPACTION

- A. Materials:
 - 1. To the maximum extent available, excess earth obtained from structure and trench excavation shall be used for the construction of fills and embankments.
 - 2. Materials used as backfill shall be free from rocks or stones larger than 2 inches in their greatest dimension; brush, stumps, logs, roots, debris, and organic or other deleterious materials; and must be acceptable to the Engineer.
 - 3. Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials be in any backfill, fill or embankment.

B. Placement and Compaction:

1. Backfill materials shall be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction.
2. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor will be required to add water and harrow, disc, blade, or otherwise work the material in each layer to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling or other method acceptable to the Engineer to 95 percent of relative density at optimum moisture content as determined by Modified Proctor Method, ASTM D1557, (latest).
3. Whenever a trench passes through a backfill or embankment, material shall be placed and compacted to an elevation 12 inches above the top of the pipe before the trench is excavated.

C. Compact and backfill excavations and construct embankments for structures according to the schedule listed in Table 02220-A. Backfill schedule for pipes is listed in Table 02220-B. (Modified Proctor shall be ASTM D-1557, latest):

D. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

E. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

F. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 8 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

G. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Engineer. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Engineer's approval will be in writing.

H. Foundation Preparation

1. The existing ground beneath proposed tankage, building foundations and equipment base slabs and slabs on grade shall be removed and the area proof-rolled. Proof-rolling should consist of at least 10 passes of a self-propelled vibrator compactor capable of delivering a minimum impact force of 30,000 to 35,000 pounds per drum to the soils. Each pass should overlap the preceding pass by 30 percent to insure complete coverage. Backfilled areas shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557 (latest) for a depth of not less than 2-feet below the bottom of the foundations or concrete slabs. Any unsuitable foundation material shall be removed and replaced with suitable material.
2. Slabs On Grade: Subgrades for concrete slabs shall be removed, backfilled, and compacted to the required grade. The top 2-feet of concrete slab subgrade in cut sections and all fill material shall be compacted in 8-inch layers to a density of not less than 95 percent of Modified Proctor Dry Density as determined by ASTM D1557, (latest).

3.08 TRENCH EXCAVATION (SEE DRAWINGS FOR DETAIL)

- A. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. Four hundred (400) feet shall be the maximum length of open trench on any line under construction. All trench excavation shall be open cut from the surface.
 1. Alignment, Grade, and Minimum Cover: The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith shall be in conformity with requirements of the section covering installation of pipe.
 2. Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 42 inches where in paved or graded streets where surface grades are definitely established and 36 inches in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath existing pipes conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation.
- B. Limiting Trench Widths:

1. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment. However, minimum permissible sidewall clearances between the installed pipe and each trench wall, expressed in inches, shall be as follows:

<u>Pipe Size</u>	<u>Minimum Sidewall Clearance</u>
60	24
54	21
48	19
36 or smaller	12

2. Stipulated minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required.
3. Cutting trench banks on slopes to reduce earth load to prevent sliding and caving will be permitted only in areas where the increased trench width will not interface with surface features or encroach on right-of-way limits. Slopes shall not extend lower than one foot above the top of the pipe.

C. Mechanical Excavation:

1. The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, and other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.
2. Mechanical equipment used for trench excavation shall be of the type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

D. Pavement Cutting:

1. Cuts in concrete pavement, asphalt pavement, and asphalt base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with an asphalt or concrete saw in a manner which will provide a clean groove for the full depth of pavement along each side of the trench and along the perimeter of cuts for structures.

2. Asphalt pavement and asphalt base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the centerline of the trench.
 3. Pavement removed for connections to existing lines or structures shall not be greater than necessary for the installation as determined by the Engineer.
- E. Artificial Foundations in Trenches: Whenever so ordered by the Engineer, the Contractor shall excavate to such depth below grade as the Engineer may direct and the trench bottom shall be brought to grade with such material as the Engineer may order installed. All piling, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the Engineer. Compensation for extra excavation and piling, concrete, or other foundations, except where provided by contract unit prices, shall be made in accordance with the contract provisions for extra work.
- F. Bell Holes: Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3.09 TESTS

- A. Testing is specified in Section 01410: Testing and Testing Laboratory Services.

3.10 DRAINAGE

- A. Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or water courses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by the Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other water courses crossed by the line of trench shall be removed immediately after backfilling is completed and the original sections, grades, and contours of ditches or water courses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3.11 FINAL GRADING

- A. After other outside work has been finished, and backfilling completed and settled, all areas on the site of the work which are to be graded shall be brought to grade with the tolerance of +/- 0.1 feet at the indicated elevations, slopes, and contours where seeding or sodding is not required or, where sodding is required within three (3) inches of finished grade. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and equivalent to hand work. All surfaces shall be graded to secure effective drainage. Unless otherwise shown, a slope of at least one percent shall be provided.
- B. After grading and where seeding is required, topsoil shall be evenly spread to a minimum depth of six (6) inches. Topsoil shall be from an Engineer approved source and shall be clear of trash, debris and surface vegetation more than six (6) inches in height.
- C. Grading and surfacing shall be completed to the satisfaction of the Engineer.

3.12 EXCESS EXCAVATED MATERIALS

- A. Insofar as needed, suitable excavated materials shall be used in fills and embankments shown on the Drawings. All suitable excess excavated material shall be placed at an on-site stockpile area as directed by the Owner.
- B. The Contractor shall segregate different types of excavated materials (i.e. sands, clayey sands) as possible in the stockpile area. All unsuitable materials shall be disposed of by the Contractor offsite in a legal manner.
- C. The Contractor shall slope and compact the stockpile with a light roller type vehicle to maintain stability.
- D. The Contractor shall maintain proper soil and erosion control measures.

3.13 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within the correction period stipulated in the General Conditions.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer or Owner.

TABLE 02220-A

**COMPACTION AND BACKFILL SCHEDULE
FOR STRUCTURES**

Area	Material	Compaction
Beneath structures, foundations, slabs, and pavements (minimum 5-foot depth below concrete foundation)	Structural Fill (Para. 2.01 C)	8-inch lifts, compacted to 95% Modified Proctor maximum dry density. Fill should not be placed over any in-place soils until those layers have been compacted to 95% Modified Proctor maximum dry density.
Around structures, foundations and slabs (minimum 5-foot spacing)	Structural Fill (Para. 2.01 C)	8-inch lifts, compacted to 95% Modified Proctor maximum dry density. Use light rubber-tired or vibratory plate compactors.
From cleared existing surface to subgrade for paved and gravel roadway surfaces	Common Fill (Para. 2.01 B)	12-inch lifts, compacted to 95% Modified proctor maximum dry density.
Disturbed area requiring seeding and mulching	Topsoil	See Section 02922

TABLE 02220-B

BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

				PIPE ENVELOPE				
				PRIMARY ZONE		SECONDARY ZONE		
Pipe Material	Pipe Size	Trench Condition	BEDDING Material	Material	Depth ^c	Material	Depth	Others
Ductile iron, stainless steel, culvert pipe and prestressed concrete cylinder pipe	<16"	Normal ^a	Compacted Common Fill	Coarse Sand	0.5 O.D.	Coarse Sand	0.5 O.D.+12"	Class II material Shouldn't have stones size >2". Organic content <1.1% by wt.
		Special ^b	Class I	Coarse Sand	0.5 O.D.	Coarse Sand	0.5 O.D.+12"	
	≥16"	Normal ^a	Class II	Common Fill	0.25 O.D.	Common Fill	--	
		Special ^b	Class I	Common Fill	0.25 O.D.	Common Fill	--	
Fiberglass, PVC and Other Plastic Pipe	<6"	Normal ^a	Coarse Sand	Coarse Sand	0.7 O.D.	Coarse Sand	0.3 O.D.+12"	
		Special ^b	Class I	Coarse Sand	0.7 O.D.	Coarse Sand	0.3 O.D.+12"	
	≥16"	Normal ^a	Class II	Class II	0.7. O.D.	Class II	0.3 O.D.+12"	
		Special ^b	Class I	Class II	0.7. O.D.	Class II	0.3 O.D.+12"	
Pipe laid in rock (min. trench requirements) except for fiberglass and PVC pipe		Rock	Class I	Class II	0.5 O.D.	Common Fill with max. stone size ≤2"	0.5 O.D.+12"	
Gravity pipe (not specified above)		Normal	Coarse Sand	Coarse Sand	0.5 O.D.	Common Fill	0.5 O.D.+12"	
Pressure pipe (not specified above)		Normal	Suitable undisturbed earth or compacted common fill	Common fill with max. stone size ≤2"	0.5 O.D.	Common fill with max. stone size ≤2"	0.5 O.D.+12"	

a Dry soils.

b Saturated soils.

c Outside Diameter of pipe = O.D.

Notes:

1. No Special bedding shall be required in case of suitable undisturbed earth type trench bottom.
2. Bedding thickness shall be 12 inches unless specified otherwise.
3. The backfill shall be compacted to 95% Modified Proctor maximum dry density and shall be placed in 6-inch lifts for pipe envelope and in 12-inch lifts from secondary zone to grade. Common fill shall be used as final backfill material.
4. It is intended that additional excavation be conducted to remove unsuitable material below the pipe bedding level which prevents bedding compaction as required herein and replace such materials with suitable materials. Over excavation, geotextile fabric, gravel blanket, granular fill and other acceptable stabilization method shall be placed within 4 feet of the bedding level or within 10 feet of the existing ground (whichever is greater depth) at no additional cost to the Owner. Construction required beyond these limits shall be executed in accordance with the General Conditions. When indicated on the Drawings, the Contractor shall remove unsuitable material below bedding level to the limits indicated and replace with coarse sand or other acceptable stabilization method up to the bedding level without any additional cost to the Owner.

END OF SECTION 02220

SECTION 02220-C
CONCRETE GROUT INJECTION PROGRAM

PART I - GENERAL

1.1 SCOPE OF WORK

1.1.1 The work covered by this section consists of providing project control, supervision, all labor and equipment, and performing all operations in connection with improvement of the soil underlying the proposed MLE Basin and Sludge Digester tanks, by injection of cement grout. Cement-grout shall begin at each primary grout injection location at the depths indicated on the Cement Grout Injection Plan and as directed by the Geotechnical Engineer. Primary grout injection points shall be placed on about 30 foot centers beneath the MLE tank and on about 20 foot centers beneath the digester tank. This should result in about 18 primary points for the MLE tank and 9 points for the digester tank. Secondary points will then be installed and injected, depending on the grout take in the primary locations.

1.1.2 The proposed cement grout injection program shall be performed to fill any voids and to densify any loose to very loose soil underlying the tanks at the specified locations shown on the plan or as directed by the Geotechnical Engineer.

1.1.3 The placement of high slump grout within the soil shall act to consolidate the surrounding soil. A slump ranging from 4 to 9 inches shall be used for the high slump grouting or as directed by the Geotechnical Engineer. The slump at the start of grouting operations shall be approximately 5 Inches. Depending on the grout intake during the cement grout-injection operation, higher or lower slump may be required by the Engineer.

1.1.4 The grouting program includes the placement of grout injection pipes at the locations shown on the plan or elsewhere as specifically approved by the Geotechnical Engineer. Soil improvements shall primarily consist of injection under pressure of a high slump grout at the specified injection points. -

1.1.5 There shall be one mobilization for this contract.

1.2 CONTRACTOR SUBMITTALS (TO BE SUBMITTED AT THE PREWORK MEETING or during daily coordination with project manager and Geotechnical Engineer.)

1.2.1 Methods of the work:

- a. Grout pipe installation procedures
- b. Maximum grout quantities at each increment of depth
- c. Grout pressures at depths

1.2.2 Daily records (ref. *Para. 3.3.*)

1.2.3 Grout mix design, design slump and tolerances

1.2.4 Heave monitoring instrumentation and procedures

1.2.5 Project management (names and telephone numbers)

1.2.6 Calibration procedures for pump equipment

1.3 CONTRACTOR QUALIFICATIONS

The following must be submitted by the successful bidders prior to contract execution. One of the conditions to be responsible is for the prequalification to be approved.

- 1.3.1 The grouting contractor shall have at least 5 years of experience with similar grouting operations to this project. The majority of the grouting projects specified shall represent a level of difficulty and/or scope complexity similar to this project.
- 1.3.2 The grouting contractor shall submit a list of personnel to be used on any project assignment outlining their experience in this type of work.
- 1.3.3 The grouting contractor shall submit a list of equipment to be used in performance of the specified grouting work, specifically detailing the equipment production and quality assurance capability.
- 1.3.4 The grouting contractor shall submit a detailed description of the cement grouting program. A detailed description of the work procedures, sequence of work and heavy monitoring program shall be included. -
- 1.3.5 The grouting contractor shall submit an approved mix design to be used and information regarding all materials and suppliers, including the source of fine aggregates.

PART 2 – PRODUCTS AND EQUIPMENT

2.1 MATERIALS

- 2.1.1 Portland Cement shall conform to Federal Specification SS-C—102 for “Cement: Portland,” or ASTM D-150
- 2.1.2 Fine Aggregate shall be natural sand material. The fine aggregate shall have a fines content of not less than 10 percent and not more than 30 percent passing the No. 200 sieve, and shall be approved by the Geotechnical Engineer. The gradation of the mix shall be such that sand blocking is eliminated at the grout working pressures specified.
- 2.1.3 Lime shall be hydrated with a minimum 95 percent passing Standard mesh sieve - ASTM C-6
- 2.1.4 Water shall be potable
- 2.1.5 Grout mix— Sand-cement mixture with appropriate additive and minimum 2-day compressive strength of 150 pounds per square inch (psi). Design mix shall be submitted to Geotechnical Engineer for approval.
- 2.1.6 Fly Ash Type “F” fly ash is allowable as a filler if the minimum compressive strength is maintained.

2.2 MIX PROPORTIONS

- 2.2.1 All materials shall be accurately measured by volume, weight, or other approved methods.
- 2.2.2 The grout mix shall include a minimum of 12 percent Portland cement of the dry weight of sand (i.e., a hypothetical mix having 100 pounds dry sand shall have a minimum 12 pounds of cement). - -
- 2.2.3 Addition of water to ensure pumpability shall not be allowed. The contractors shall evaluate and adjust source and characteristics of sand, and adjust mix proportion including sand, fly ash, and other mix components.
- 2.2.4 Calibration of grout pumps shall be required as directed by the Geotechnical Engineer.
- 2.2.5 Ready mix tickets shall be saved, submitted to the Department, and made part of the permanent project records.
- 2.2.6 The proposed mix design shall be submitted to the Geotechnical Engineer for approval to proceed. Approval does not imply acceptance. The contractor is responsible for mix, strength, pumpability etc.
- 2.2.7 The grout mix proportions shall be adjusted each point of injection, and from batch to batch during injection, if necessary, to obtain optimum grout pumpability consistent with requirements of Part No.2 in the General Section of this specification.

2.3 EQUIPMENT

- 2.3.1 Prior approval ~ required for all pumping equipment to be used in the preparation or handling of grout. All oil or rust inhibitors shall be removed from any portions of the equipment in contact with the grout before the mixers are used. All equipment shall be maintained in first class condition at all times.
- 2.3.2 Pressure grout pumps shall have a variable range of rate of delivery between 1 cubic foot per minute and 10 cubic feet per minute and shall be equipped with on-line pressure gauges with range of 50-500 psi and remote controls capable of reaching all the grout injection points
- 2.3.3 Approval of equipment onto the job site does not imply final acceptance. Final acceptance is subject to satisfactory field performance.
- 2.3.4 The contractor shall provide vertical survey control in the vicinity of each injection point to determine when surface heave has occurred.
- 2.3.5 The contractor's equipment used for installation of the grout casing shall have the capability of installing injection pipes on angles.

PART 3 - EXECUTION

3.1 INJECTION POINT SPACING AND PLACEMENT

- 3.1.1 Primary grout Injection pipes shall be drilled and/or driven, not jetted, through the service sands and underlying soils to approximate depths ranging from 25 to 35 feet below existing ground surface elevation. The pipes will generally be installed to the top of the weathered limestone. The actual depths may be more or less than this range due to variations in the depth to limestone. Variation in depth shall be at the direction of the Geotechnical Engineer. If drilling option is elected the size of the augured hole shall be smaller than the injection pipes

and the injection pipes shall be hammered to the augured depth.

- 3.1.2 The injection pipes shall be installed at the locations shown on the CGIP or as directed by the Geotechnical Engineer. Dependent upon the grout take and grout injection pipe depths for the initially planned primary injection points, additional grout injection pipes at the secondary injection points may be required.
- 3.1.3 All changes in injection pipe spacing, grout delivery pressure, and allowable quantities of grout at a given depth and location shall be as directed by the Geotechnical Engineer.
- 3.1.4 The use of rotary wash frilling techniques for installation of grout is not permitted on the project.
- 3.1.5 The diameter of injection pipes shall be adequate to permit injection of cement grout. The injection pipes should have a minimum of 2 Inches and a maximum of 4 Inches in diameter. "Nippled" casing shall not be allowed. Hard caps able to withstand the casing driving force shall be used at the pipe bottom to prevent soil plugging into the casing during grout pipe Installation: The use of augers in lieu of injection pipes is not acceptable.
- 3.1.6 For all injection points, accurate installation records shall be kept by the contractor, including location and depth of injection points, method of installation, and other pertinent data such as difficulties encountered during drilling or pipe driving.

3.2 GROUT INJECTION PROCEDURES

- 3.2.1 The grouting shall preferably proceed in alternating locations so that a minimum 4 to 6 hours curing time elapses prior to drilling and grouting adjacent holes.
- 3.2.2 The injection of grout shall begin at the bottom depth of the injection pipe and proceed upward in 2-foot Intervals to a depth of approximately 4 feet below the existing grade or as directed by the Geotechnical Engineer.
- 3.2.3 A maximum grout line pressure of 100 psi over the static pressure is recommended.
- 3.2.4 The grouting program shall commence with a test program to enable evaluation of equipment performance and selection of grout pressure criteria and refusal criteria. Injection at each interval shall continue until one of the following occurs:
 - A. Maximum grout pressures at the ground surface of 200 psi are achieved or as otherwise directed by the Geotechnical Engineer.
 - B. Maximum grout "take" quantity of 10 cubic yards within a 2-foot interval occurs. -
 - C. A maximum 50 cubic **yards** shall be placed at any grout injection point. Secondary injection points shall be installed at the direction of the Geotechnical Engineer.
 - D. Maximum (total- not each Interval) surface heave shall be one quarter (1/4) inch adjacent to each injection point and one eighth (1/8) inch adjacent to any structure. Payment will not be authorized for grouting resulting in excessive heave.
- 3.2.5 Grouting procedure shall continue with the grout pipe withdrawn in a controlled manner and with sufficient pressure on the grout to assure that the drilled hole is filled with grout-to prevent a breaching of any clay layer present. The Geotechnical Engineer may stop the withdrawal at pre-selected depth intervals for the grouting of voids or near-void conditions,

- 3.2.5 In general, injection at each interval shall continue, except as specifically otherwise approved, until one of the following occurs:
- A. Maximum grout pressure of 100 psi increase over the static line pressure.
 - B. Maximum grout pressures at the ground surface of 200 psi or as directed by the Geotechnical Engineer.
 - C. Maximum grout quantity of 10 cubic yards per 2-foot interval.
 - D. Maximum 50 cubic yards of grout injected each grout injection point.
 - E. Surface heave of more-than 1/16 inch per 2-foot interval.

The above criteria may be altered by the Geotechnical Engineer during grouting depending upon field conditions.

3.3 CONTRACTORS SUPERVISION AND QUALITY CONTROL

- 3.3.1 Accurate records shall be kept by the contractor for grout mix proportions, quantities of grout take and injection pressures. The actual sequence of grouting operations, proportions of grout mixes, etc. shall be as herein provided, except that the provisions may be modified by the Geotechnical Engineer as required by field conditions.
- 3.3.2 All daily drilling, grouting and testing reports shall be submitted to the Geotechnical Engineer within 48 hours.
- 3.3.3 Drilling reports shall be required and shall contain at least the following information:
Name of driller, type of drill, method being used, date started, date completed, location of hole, type and depth of materials encountered.
- 3.3.4 Grouting reports shall be required and shall contain at least the following information:
Name of grout technician, constituents and proportions of grout, log of quantity injected per lineal foot of hole, date, rate of pumping, and pressure at the hole.
- 3.3.5 A level control system shall be installed and operated by the contractor for use during grouting. The monitoring shall be carried out so as to detect any movement within 50 feet of the grouting operations whenever grouting is occurring.
- 3.3.6 Calibration for volume production, pressure loss, and slump loss shall be performed to the satisfaction and at the frequency directed by the Geotechnical Engineer.

3.4 TESTING AND QUALITY

- 3.4.1 The testing and on-site observation shall be done by the Geotechnical Engineer. His activities shall include, but are not limited to, observing the grouting activities and monitoring grout volumes and depths.
- 3.4.2 The Geotechnical Engineer reserves the right to perform Standard Penetration Test truth borings in improved areas to evaluate the success of the grouting operation. Truth borings may be performed during the grouting operations and again prior to the grouting completion.
- 3.4.3 The Geotechnical Engineer reserves the right to perform slump test in the field and compressive strength test on grout samples.

3.5 MEASUREMENT AND PAYMENT

3.5.1 The approved grouting contractor shall submit a bid based on the following units.

Item No.	Description	Unit
1	Mobilization / Demobilization	EA
2	M.O.T	Per Day
3	Estimated grout injection point piping	10,395 L.F
4	Estimated cubic yards of grout	900 Cu. Yds.
5	Grout ordered by flat pumped	Cu. Yds

3.5.2 Payment will be made solely at the bid prices, based on actual quantities performed. Additional payment for remobilization shall be made only where contractor was authorized by the Geotechnical Engineer to demobilize from the site (job assignment) and not as a result of variations in the scope or quantity of the grouting program or time of performance.

END OF SECTION

SECTION 02425

DRAINAGE INLETS, MANHOLES, AND JUNCTION BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Construct inlets, manholes, and junction boxes from reinforced concrete as shown in the FDOT Design Standards and the plans. Brick masonry may be used if the structure is circular and constructed in place. Furnish and install the necessary metal frames and gratings.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Concrete: For inlets, manholes, and junction boxes, use Class II or IV concrete, as designated in the plans and FDOT Design Standards.
- B. Mortar: For brick masonry, make the mortar by mixing one part portland cement to three parts sand. Masonry cement may be used in lieu of the above-specified mortar provided it is delivered in packages properly identified by brand name of manufacturer, net weight of package, and whether it is Type 1 or Type 2, and further provided that it has not been in storage for a period greater than six months.
- C Gratings: Use gratings and frames fabricated from structural steel or cast iron as designated in the appropriate Design Standard. When "Alt. G" grates are specified in the plans, provide structural steel grates that are galvanized in accordance with the requirements of ASTM A 123.
- D. Forms: Design and construct wood or metal forms so that they may be removed without damaging the concrete. Build forms true to line and grade and brace them in a substantial and unyielding manner. Obtain the Engineer's approval before filling them with concrete.
- E. Precast Inlets, Manholes, and Junction Boxes: Precast inlets, manholes and junction boxes, designed and fabricated in accordance with the plans, the FDOT Design Standards and Section 02449, may be substituted for cast-in-place units.

PART 3 – EXECUTION

3.01 EXCAVATION

- A. Excavate as specified in Section 02200
- B. Where unsuitable material for foundations is encountered, excavate the unsuitable material and backfill with suitable material prior to constructing or setting inlets, manholes and junction boxes.
- C. As an option to the above and with the Engineer's approval, the Contractor may carry the walls down to a depth required for a satisfactory foundation, backfill to 8 inches below the flowline with clean sand and cast a non-reinforced 8 inch floor.

3.02 PLACING AND CURING CONCRETE

- A. Place the concrete in the forms, to the depth shown in the plans, and thoroughly vibrate it. After the concrete has hardened sufficiently, cover it with suitable material and keep it moist for a period of three days.

3.03 SETTING MANHOLE CASTINGS

- A. After curing the concrete as specified above, set the frame of the casting in a full mortar bed composed of one part portland cement to two parts of fine aggregate.

3.04 LAYING BRICK

- A. Saturate all brick with water before laying. Bond the brick thoroughly into the mortar using the shovejoint method to lay the brick. Arrange headers and stretchers so as to bond the mass thoroughly. Finish the joints properly as the work progresses and ensure that they are not less than 1/4 inch or more than 3/4 inch in thickness. Do not use spalls or bats except for shaping around irregular openings or when unavoidable at corners.

3.05 BACKFILLING

- A. Backfill as specified in Section 02220, meeting the specific requirements for backfilling and compaction around inlets, manholes, and junction boxes.

END OF SECTION

SECTION 02430

DRAINAGE PIPE CULVERTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Furnish and install drainage pipe and end sections at the locations called for in the plans. Furnish and construct joints and connections to existing pipes, catch basins, inlets, manholes, walls, etc., as may be required to complete the work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Pipe: Meet the following requirements:
 - 1. Concrete Pipe: Section 02449
 - 2. Round Rubber Gaskets: Section 02942
- B. Joint Materials: Use joint materials specified in this section according to type of pipe and conditions of usage.
- C. Mortar: Use mortar composed of one part portland cement and two parts of clean, sharp sand, to which mixture the Contractor may add hydrated lime in an amount not to exceed 15% of the cement content. Use mortar within 30 minutes after its preparation.

2.02 TYPE OF PIPE

- A. General: When the plans designate a type (or types) of pipe, use only the type (or choose from the types) designated. As an exception, when the plans designate reinforced concrete pipe as Class S, Class I, Class II, Class III and Class IV, the Contractor may use non-reinforced concrete pipe up to and including 36 inch in diameter or fiber reinforced concrete pipe up to and including 48 inch in diameter.

PART 3 – EXECUTION

3.01 LAYING PIPE

- A. Lay all pipe, true to the lines and grades given, with hubs up grade and tongue end fully entered into the hub. When pipe with quadrant reinforcement or circular pipe with elliptical reinforcement is used,

install the pipe in a position such that the manufacturer's marks designating "top" and "bottom" of the pipe are not more than five degrees from the vertical plane through the longitudinal axis of the pipe.

- B. Do not allow departure from and return to plan alignment and grade to exceed 1/16 inch per foot of nominal pipe length, with a total of not more than 1 inch departure from theoretical line and grade. Take up and relay any pipe that is not in true alignment or which shows any settlement after laying at no additional expense to the Owner.
- C. Do not use concrete pipe with lift holes except round pipe which has an inside diameter in excess of 54 inches or any elliptical pipe.
- D. Repair lift holes, if present, by use of a hand-placed, stiff, non-shrink, 1-to-1 mortar of cement and fine sand, after first washing out the hole with water. Completely fill the void created by the lift hole with mortar. Cover the repaired area with a 24 by 24 inches piece of filter fabric secured to the pipe. Use a Type D-3 filter fabric meeting the requirements shown on FDOT Design Standards, Index 199. Secure the filter fabric to the pipe using a method that holds the fabric in place until the backfill is placed and compacted. Use a grout mixtures, mastics, or strapping devices to secure the fabric to the pipe.
- F. When installing pipes in structures, construct inlet and outlet pipes of the same size and kind as the connecting pipe shown in the plans. Extend the pipes through the walls for a distance beyond the outside surface sufficient for the intended connections, and construct the concrete around them neatly to prevent leakage along their outer surface as shown on the FDOT Design Standards, Index 201. Keep the inlet and outlet pipes flush with the inside of the wall.
- G. Furnish and install a filter fabric jacket around all pipe joints and the joint between the pipe and the structure in accordance with FDOT Design Standards, Index Nos. 201 and 280. Use fabric meeting the physical requirements of Type D-3 specified on the FDOT Design Standards, Index 199. The fabric shall extend a minimum of 12 inches beyond each side of the joint or both edges of the coupling band, if a coupling band is used. The fabric shall have a minimum width of 24 inches, and a length sufficient to provide a minimum overlap of 24 inches. Secure the filter fabric jacket against the outside of the pipe by metal or plastic strapping or by other methods approved by the Engineer.
- H. Meet the following minimum joint standards:

Pipe Application	Minimum Standard
Storm and Cross Drains	Water-tight
Gutter Drain	Water-tight
Side Drains	Soil-tight

When rubber gaskets are to be installed in the pipe joint, the gasket shall be the sole element relied on to maintain a tight joint. Soil tight joints must be watertight to 2 psi. Water-tight joints must be water-tight to 5 psi unless a higher pressure rating is required in the plans.

3.02 TRENCH EXCAVATION

- A. Excavate the trench for storm and cross drains, and side drains as specified in Section 02220.

3.03 FOUNDATION

- A. Provide a suitable foundation, where the foundation material is of inadequate supporting value, as determined by the Engineer. Remove the unsuitable material and replace it with suitable material, as specified in 02220. Where in the Engineer's opinion, the removal and replacement of unsuitable material is not practicable, he may direct alternates in the design of the pipe line, as required to provide adequate support. Minor changes in the grade or alignment will not be considered as an adequate basis for extra compensation.

3.04 BACKFILLING

- A. Backfill around the pipe as specified in 02220 unless specific backfilling procedures are described in the Contract Documents.

3.05 END TREATMENT

- A. Place an end treatment at each storm and cross drain, and side drain as shown in the plans. Refer to the FDOT Design Standards for types of end treatment details.
 - 1. As an exception to the above, when concrete mitered end sections are permitted, the Contractor may use reinforced concrete U-endwalls, if shop drawings are submitted to the Engineer for approval prior to use.

3.06 SPECIFIC REQUIREMENTS FOR CONCRETE PIPE

- A. Sealing Joints: Seal the pipe joints with round rubber or profile gaskets

meeting the requirements of Section 02449. Ensure that the gasket and the surface of the pipe joint, including the gasket recess, are clean and free from grit, dirt and other foreign matter, at the time the joints are made. In order to facilitate closure of the joint, application of a vegetable soap lubricant immediately before closing of the joint will be permitted. Prelubricated gaskets may be used in lieu of a vegetable soap lubricant when the lubricating material is certified to be inert with respect to the rubber material.

- B. Laying Requirements for Concrete Pipe with Rubber Gasket Joints: Do not allow the gap between sections of pipe to exceed $\frac{5}{8}$ inch for pipe diameters of 12 inches through 18 inches, $\frac{7}{8}$ inch for pipe diameters of 24 through 66 inches, and 1 inch for pipe diameters 72 inches and larger. Where minor imperfections in the manufacture of the pipe create an apparent gap in excess of the tabulated gap, the Engineer will accept the joint provided that the imperfection does not exceed $\frac{1}{3}$ the circumference of the pipe, and the rubber gasket is $\frac{1}{4}$ inch or more past the pipe joint entrance taper. Where concrete pipes are outside of these tolerances, replace them at no expense to the Owner. Do not apply mortar, joint compound, or other filler to the gap which would restrict the flexibility of the joint.

END OF SECTION

SECTION 02449

PRECAST CONCRETE DRAINAGE PRODUCTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Precast concrete drainage products hereinafter called products, may include but are not limited to, round concrete pipe, elliptical concrete pipe, underdrains, manholes, endwalls, inlets, junction boxes, three-sided precast concrete culverts, and precast concrete box culverts.
- B. Ensure that all precast drainage products are designed and manufactured in accordance with the requirements of the Contract Documents.
- C. Obtain precast concrete pipes, box culverts, and drainage structures from a plant that is currently on the Florida Department of Transportation's list of Producers with Accepted Quality Control Programs.
- D. At the beginning of each project, provide a notarized statement to the Engineer from a company designated representative certifying that the plant will manufacture the products in accordance with the requirements set forth in the Contract Documents and plant's Quality Control Plan. The Quality Control Manager's stamp on each product indicates certification that the product was fabricated in conformance with the Contractor's Quality Control Plan, the Contract, and this Section. Ensure that each shipment of precast concrete products to the project site is accompanied with a Quality Control signed or stamped delivery ticket providing the description and the list of the products.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ensure that the materials used for the construction of the precast drainage products have a certification statement from the source, showing that they meet the applicable requirements of the Specifications with the following modifications:
 - 1. Portland Cement and blended cement.....Section 02921
 - 2. Gasket Material.....Section 02942

3. Blended Hydraulic Cements.....AASHTO M 240
 4. Welded Wire Fabric.....ASTM A 185 or ASTM A 497
 5. Wire for Site Cage Machines...ASTM A 82, ASTM A 496 or ASTM A 615
- B. Unless otherwise stipulated within the Contract Documents, meet the following requirements for concrete mix, product design, fabrication, transportation, and installation:
1. Pipe Culverts and Storm Sewers.....Section 02430
 2. Inlets, Manholes, and Junction Boxes Section 02425 and ASTM C 478
 3. Reinforced Elliptical Concrete Pipe.....ASTM C 507
 4. Non-reinforced Concrete Pipe.....ASTM C 985
 5. Fiber Reinforced Concrete Pipe.....ASTM C 1450

2.02 CONCRETE PIPE

- A. Special Requirements for Steel Reinforced Concrete Pipe: Use pipe meeting the requirements of ASTM C 76 with the modifications as described in 2.02 (B). Use Special Designed pipe meeting the requirements of ASTM C 655. Use Class S pipe meeting the requirements of ASTM C 655 and the 0.01 inch crack and ultimate D - loads given on the FDOT Design Standards, Index No. 205. Ensure all pipes are properly marked.
- B. Modifications to ASTM C 76 and ASTM C 507: The following supersedes the provisions of ASTM C 76 and ASTM C 507:
 1. Ensure all materials used in concrete are certified from the source and conform to the requirements of 02449.
 2. Ensure all Joint Reinforcement requirements are in accordance with the FDOT Design Standards.
 3. Ensure the manufacturer has a suitable apparatus for testing each product in accordance with ASTM C 497 and performs all tests outlined in ASTM C 497 when requested by the Engineer.
 4. Ensure that the variation of laying lengths of two opposite sides of pipe is not more than 1.04% of the diameter, with a

maximum of 1/2 inch in any length of pipe, except where beveled-end pipe for laying on curves is specified.

5. Ensure that the type of wall markings is included on all precast pipes.

C. Special Requirements for Non-Reinforced Concrete Pipe

1. Ensure the requirements of ASTM C 985 and the ultimate D - loads given on the FDOT Design Standards, Index 205 are met with the following exception:

(a) Modify material requirements set forth in ASTM C 985 with the material requirements set forth in 02449. Ensure all pipes are properly marked.

D. Special Requirements for Reinforced Elliptical Concrete Pipe

1. Use elliptical concrete pipes conforming to the requirements of ASTM C 507, except for the exceptions and modifications as specified in 02449. Ensure the requirements of Table I of ASTM C 507 for standard elliptical pipe, the requirements of Class HE-III and Class HE-IV of Table I of ASTM C 507 for Standard elliptical pipe and special elliptical pipe, respectively are met and the joint design requirements set forth in Article 7 of ASTM C 443 are met.

E. Rejection of Concrete Pipe

1. Specific causes for rejection of concrete pipe, in addition to any failure to meet the general requirements specified in the Contract Documents, are as follows:

a) Failure to meet the requirements listed in ASTM C 76 for permissible variations in dimensions.

b) Occurrence of defects listed in ASTM C 76.

2.03 FIBER REINFORCED CONCRETE PIPE

A. Special Requirements for Fiber Reinforced Concrete Pipe

1. Use fiber reinforced concrete pipe meeting the requirements of ASTM C 1450.
2. Use only pipes that are properly marked.
3. Use pipe meeting the applicable material requirements set forth

in 02449. In addition, fiber reinforced concrete pipe must be designated Class S, Class I, Class II, Class III or Class IV. The corresponding strength requirements are given in the following table:

Minimum Long-Term Service D-Load	
Pipe Class	Lb/ft/ft
S	600
I	800
II	1,000
III	1,350
IV	2,000

4. Ensure the relationship between short-term crush loads required to achieve 100-year long-term design loads and the relationship between the saturated and dry crush loads are provided. The minimum dry crush load can not be less than a factor of 2 times the long-term service load. The short term crush load will be determined as required in Section 10.2 of ASTM C 1450 except the specimen will be tested by the appropriate section of ASTM C 497, External Load Crushing Strength by the Three-Edge Bearing Test Method.

2.04 REQUIREMENTS FOR PIPE JOINTS WHEN RUBBER GASKETS ARE TO BE USED

- A. Design of Joint: Use pipe joint of the bell-and-spigot type or the double spigot and sleeve type, meeting the requirements called for in the Design Standards. Ensure the joint is so proportioned that the spigot, or spigots, will readily enter the bell or sleeve of the pipe.
- B. Ensure the joint ring forms for forming the joint surface are made of either heavy steel, cast iron, or aluminum, and accurately machined to the dimensions of the joint. They must be a true circular form within a tolerance of 1/32 inch. Dimensional checks of joint ring form will indicate for each size pipe a length of spigot, or tongue, not more than 1/8 inch shorter than the bell, or groove, depth. The pipe will be so manufactured that joint surfaces are concentric with the inside of the pipe within a tolerance of 3/32 inch. The shape and dimensions of the joint must be such as to provide compliance with the following requirements:
 1. The joint must be so dimensioned that when the gasket is

placed on the spigot it will not be stretched more than 20% of its original length, or the maximum stretch length that is recommended by the manufacturer, whichever is lower.

2. The space provided for the gasket must be a groove in the spigot end of the pipe and such space, when the joint is made, it cannot be more than 110% of the volume of the gasket.
3. The joint must be designed so that when the outer surface of the spigot and the inner surface of the bell come into contact at some point on the periphery, the diametric deformation in the gasket at the point of contact cannot be greater than 50% of the normal gasket diameter, and the diametric deformation in the gasket at a point opposite the contact point cannot be less than 20% of the normal gasket diameter.
4. When the pipes are joined, there must be parallel surfaces on both the bell and the spigot, extending from the outside edge of the gasket toward the bell face for a distance of not less than 3/4 inch. These parallel surfaces cannot be farther apart than 1/8 inch, when the spigot is centered in the bell. The tapers on these surfaces cannot exceed three degrees.
5. The inside surface of the bell at the end of the bell must be flared to facilitate joining the pipe sections without damaging or displacing the gasket.

C. When Rubber gaskets are Used

1. Ensure that the pipe joints have been tested at the plant hydrostatically.

D. When Profile Rubber Gaskets are Used

1. Ensure the joint design meets the requirements set forth in Article 7 of ASTM C 443.

E. Tolerances in Imperfections, and Permissible Repairs for Joint of Concrete Gasketed Pipe

1. Ensure that all surfaces of near-contact of the jointed pipes are free from air holes, chipped or spalled concrete, laitance, and other such defects.
2. Pipes showing minor manufacturing imperfections or handling injuries to the bell or spigot may be acceptable if such defects are acceptably repaired as prescribed below.

3. Individual air holes (trapped air), or spalled areas with a length of up to one-half the pipe radius, or 12 inches whichever is less, may be repaired by careful use of a hand-placed, stiff, pre-shrunk, 1-to-1 mortar of cement and fine sand, and with no additional preparation other than a thorough washing with water of the defect. Curing will be done either by moisture curing under wet burlap or by application of an approved membrane curing compound. Such repaired pipe which is sound, properly finished and cured, and which otherwise conforms to specification requirements will be acceptable.
4. Exposed reinforcing and minor spalling in the spigot groove may be accepted if repaired in the following manner: The spalled areas will be chipped back to solid concrete. Exposed reinforcing will be cleaned of all laitance and scale. The entire area is to be coated with an approved epoxy at a thickness of 5 to 10 mils. The coating must be smooth and conform to the shape of the groove.

END OF SECTION

SECTION 02830

CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included in this Section consists of furnishing and installing a zinc-coated (galvanized) steel chain-link fence, nominally 6 feet high, complete with (1) one double 12 feet wide fence gate (24 feet wide opening) to be constructed across the access road as indicated on the Drawings.
- B. Repair and replace damaged fence due to construction activities.

1.02 QUALITY ASSURANCE

- A. Erection Qualifications: The fencing erector must be a firm experienced the erection of fencing and accessories of the types specified. The erector must be approved by the manufacturer of the fencing.
- B. Design Criteria: Comply with the standards of the Chain-link Fence Manufacturer's Institute for Galvanized Steel Chain-link Fence Fabric, Federal Specification RR-F-191/1A, unless otherwise shown or specified.
- C. Sole Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 - 1. ASTM A-53, Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses.
 - 2. ASTM A-90, Test Method for Weight of coating on Zinc-Coated (galvanized) Iron or Steel Articles.
 - 3. ASTM A-392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - 4. ASTM A-569, Specification for Steel, Carbon (0.15 Maximum Percent), Hot-rolled sheet and strip, commercial quality.

5. Chain-link Fence Manufacturers Institute, Galvanized Steel Chain-Link Fence Fabric.
6. Federal Specifications, RR-F-191/1A, Fencing and Wire and Post, and Metal (Chain-Link Fence Fabric).

1.03 SUBMITTALS

- A. Shop Drawings: Submit shop drawings in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.
 1. Shop Drawings for chain-link fence system including plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, footings, hardware list and erection procedures.
 2. Descriptive literature of materials to be provided to determine compliance with the specifications.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials shall be in manufacturer's original packaging with all tags and labels intact and legible.
- B. Handle and store materials in such a manner as to avoid damage.

1.05 WARRANTY AND GUARANTEES

- A. All equipment supplied under this section shall be warranted for a period of one (1) year by the manufacturer. Warranty period shall commence upon Owner final acceptance as specified in the General and Supplementary Conditions.
- B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment 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 period. No exception to this provision shall be allowed.
- D. Refer to the General Conditions and Section 01740 for additional guarantee and warranty requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Fabric: The fabric shall be zinc-coated (galvanized) steel chain-link 96 inches high, No. 9 gauge wire woven in a 2 inch mesh. Bottom selvage shall be barbed, top selvage shall be knuckled. The fabric shall conform to the requirements of ASTM Designation A-392. The zinc coating shall be a minimum of 2.0 ounces per square foot complying with ASTM A-392. The weight of coating shall be determined as defined in ASTM Designation A-90.
- B. Posts and Other Appurtenances: All posts and other appurtenances used in the construction of this fence shall be hot dipped galvanized with a minimum of 1.8 ounces per square foot of surface. Pipe sections shall conform to the requirements of ASTM Designation A-53.
- C. Sizes of Posts, Rails are identified in Table 02830-A.
- D. Cantilever Gate:
 - 1. Fabricate cantilever gate perimeter frames of tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware, and accessories. Provide upright and diagonal bracing rails as required for gate leaf 8 feet and wider. Fabricate as follows:
 - a. Horizontal top and bottom frame members:

2.375 in. OD Schedule 40 pipe weighing 3.65 lbs. per lin. ft.,
2 in. square tubing weighing 4.32 lbs. per lin. ft.
 - b. For gates over 6 ft. high, or leaf width exceeding 8 ft., interior upright bracing:

1.90 in. OD Schedule 40 pipe weighing 2.72 lbs. per lin. ft., or
1.50 in. square tubing weighing 2.60 lbs. per lin. ft.
 - c. Interior diagonal bracing:

1.66 in. OD Schedule 40 pipe weighing 2.27 lbs. per lin. ft., or
1.50 in. square tubing weighing 1.90 lbs. per lin. ft.
 - 2. Assemble gate frames by welding or with special malleable or pressed steel fittings and rivets for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach

stretchers to gate frame on all sides at not more than 15 inches on center. Attach hardware with rivets or by other means which will provide security against removal or breakage.

3. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.
4. Gate Hardware: Furnish the following hardware and accessories for each gate.
 - a. Hinged Swing Gates: Provide manufacturer's standard heavy-duty posts, overhead framing and supports, guides, stays, bracing, and accessories as required.
- E. Posts, Braces, Rails and Gate Frames - Option: Steel pipe manufactured from steel conforming to ASTM A-569, cold-rolled and coated with a minimum of 0.9 ounces of zinc per square foot, a minimum of 15 micrograms of zinc chromate per square inch and a minimum of 3 mils cross link polyurethane acrylic exterior coating may be furnished in lieu of round posts of Paragraphs 2.01B. and 2.01C. Steel pipe shall be of the same external dimension as round posts for the respective uses with minimum wall thickness as designated in Table 02830-B.
- F. Top Rail: The top rail shall be provided with couplings approximately every 20 feet. Couplings are to be the outside sleeve type, at least 6 inches long.
- G. Concrete: Concrete shall have a minimum compressive strength of 3,000 psi at 28 days.
- H. Hardware: Miscellaneous hardware shall be of steel, malleable iron or ductile iron of standard design and conform to the requirements of the Chain-Link Fence Manufacturer's Institute. All parts shall be galvanized except ties and clips may be of aluminum.

PART 3 - EXECUTION

3.01 ARRANGEMENT

- A. Posts: Post shall be uniformly spaced, not to exceed 10 feet on centers. Intermediate posts shall have waterproof tops which have integrally cast openings through which the top rails shall pass. Terminal posts shall consist of end, corner and pull posts.
- B. Braces: Braces shall be provided at each gate, corner, pull and end post.

- C. Top Rails: The top rails shall pass through the line post tops and form a continuous brace from end to end of each stretch of fence. The top rail shall be securely fastened to the terminal posts by heavy pressed steel brace bands and malleable end connections.
- D. Bottom Tension Wire: The bottom tension wire shall be No. 7 gauge aluminum coated spring coil and crimped wire. Minimum weight of aluminum coating shall be 0.40 ounces per square foot of wire surface. The tension wire shall be stretched taut between terminal posts and securely fastened to each intermediate post 6 inches above the finish grade line. Tension wire shall be attached to the fence fabric with aluminum hog rings every 24 inches.
- E. Stretcher Bars: Stretcher bars shall be no less than 3/16 inch by 3/4 inch in cross section and shall have a minimum length 2 inches shorter than the fabric height. Stretcher bars shall be used for attaching the fabric to all terminal posts by threading through the fabric and being attached to the posts with 11 gauge tension bands, or other positive mechanical means, spaced at 12 inch centers. One (1) stretcher bar shall be provided for each gate and end post and two (2) of each corner and pull post.
- F. Ties and Clips: Fabric shall be fastened to all intermediate posts with 9 gauge tie wires, spacing not to exceed 12 inches apart. Fabric shall be tied to top rail with 9 gauge tie wires, spacing not to exceed 14 inches on centers.

3.02 INSTALLATION

- A. Post Setting: Line posts shall be set in holes 16 inches in diameter, 38 inches deep with 36 inch post embedment. Terminal posts shall be set in holes 15 inches diameter, 38 inches deep with 36 inch post embedment. After the post has been set and plumbed, the hole shall be filled with concrete. The exposed surface of the concrete shall be crowned to shed water.
- B. Terminal and Gate Posts: Terminal and gate posts shall be set as specified in the drawings and shall be braced to the nearest post with a galvanized horizontal brace used as a compression member a galvanized 3/8 inch steel truss rod and truss tighten used as a tension member.
- C. Fabric: Fabric shall not be stretched until concrete footings have cured a minimum of three days. Chain-link fabric shall be placed on the side designated by the Engineer and shall be stretched taut approximately 2 inches above finish grade and securely fastened to all posts. Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

TABLE 02830-A

DIMENSIONS OF POSTS, RAILS AND GATE FRAMES

<u>Designation</u>	<u>Nominal Diameter (Inches)</u>	<u>Outside Diameter (Inches)</u>	<u>Thickness (Inches)</u>	<u>Pounds Per Foot Plain Ends</u>
End, corner and pull posts	2.50	2.875	0.203	5.79
Gate posts (one (1) leaf width over 18 feet)	8.00	8.625	0.322	28.55
Gate posts (one (1) leaf width 13 feet to 18 feet)	6.00	6.625	0.280	18.97
Gate posts (one (1) leaf width 6 feet to 13 feet)	3.50	4.000	0.226	9.11
Gate posts (one (1) leaf width 6 feet or less)	2.50	2.875	0.203	5.79
Intermediate posts	2.00	2.375	0.154	3.65
Braces	1.25	1.660	0.140	2.27
Top Rails	1.25	1.660	0.140	2.27

TABLE 02830-B

STEEL PIPE MINIMAL
WALL THICKNESS

Outside Dimension <u>(Inches)</u>	Wall Thickness <u>(Inches)</u>
1.66	0.111
1.90	0.120
2.375	0.130
2.875	0.160

END OF SECTION

SECTION 02921

PORTLAND CEMENT AND BLENDED CEMENT

PART 1 – GENERAL

1.01 TYPE OF CEMENT

- A. Cement shall conform to the requirements of the following AASHTO designations except where a particular type of cement is specified on the plans or Specifications, cement may be Types I, II, III, IV, V (AASHTO M 85), or IP, IP (MS), IS (AASHTO M 240). Different brands of cement, cement of the same brand from different facilities, or different types of cement shall be stored separately and shall not be mixed.

1.02 ALKALI CONTENT

- A. Only Portland cement containing a maximum of 0.60% alkali, or less, calculated as Na₂O (% Na₂O plus 0.658% K₂O), may be used with no further testing. When tests performed in accordance with ASTM C-33 X1.3 on coarse and fine aggregate indicate the aggregate to be non-reactive to alkalis, cements exceeding 0.60% alkali is allowed, but a supplementary cementitious material meeting the requirements of Section 929 shall be used.

1.03. HEAT OF HYDRATION

- A. When the cement heat of hydration is 80 cal/g or less at seven days, the cement may be used in moderately and slightly aggressive environments without pozzolans or slag. If the heat of hydration is between 81 and 88 cal/gm at 7 days, pozzolans or slag meeting the requirements of Section 929 shall be used. If the heat of hydration is greater than 88 cal/gm at 7 days, use cement in slightly aggressive environments only.
 - 1. Do not apply these requirements to Type I or III cement.

END OF SECTION

SECTION 02922

LOAMING, SEEDING, AND MULCHING

PART 1- GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed, seed and mulch and establish a stand of grass in those areas shown on contract drawings and as specified.
- B. Areas seeded shall include all areas disturbed during construction except structures, roadways, walkways, and areas to be sodded.

1.02 SUBMITTALS

- A. Submit to the Engineer as provided in Section 01340, identification labels and certification that all seed is Argentine Bahia or Bermuda.

PART 2 - PRODUCT

2.01 LOAM

- A. Loam (topsoil) shall be fertile, natural soil, typical of the locality, free from large stones, roots, sticks, peat, weeds and sod, and obtained from naturally well-drained areas. It shall not be excessively acid or alkaline, nor contain toxic material harmful to plant growth. Topsoil stockpiled under other Sections of this Division may be used, but the Contractor shall furnish additional loam at his own expense, if required.

2.02 SOIL CONDITIONERS

- A. Fertilizer:
 - 1. Fertilizer shall be a complete fertilizer, the elements of which are derived from organic sources. Fertilizer shall be a standard product complying with State and Federal fertilizer laws.
 - 2. Percentages of nitrogen, phosphorus and potash shall be based on laboratory tests on soils outlined in Paragraph 1.02.A, and approved by the Engineer. For the purpose of bidding, assume 6% nitrogen, 6% phosphorus, and 6% potash by weight. At least 50% of the total nitrogen shall contain no less than 3% water-insoluble nitrogen.

3. Fertilizer shall be delivered to the site, mixed as specified, in the original unopened standard sized bags showing weight, analysis and name of manufacturer. Containers shall bear the manufacturer's guaranteed statement of analysis, or a manufacturer's certificate of compliance covering analysis shall be furnished to the Engineer. Store fertilizer in weatherproof place and in such a manner that it will be kept dry and its effectiveness will not be impaired.
- B. Superphosphate shall be composed of finely-ground phosphate rock as commonly used for agricultural purposes containing not less than 20 available phosphoric acid.
- C. Lime shall be ground limestone.

2.03 SEED

- A. Species to be Argentine Bahia or Bermuda Seed. The specified seed shall have a minimum pure seed content of 95 percent (95%) with a minimum germination of 80 percent.
- B. Dry Mulch: The mulch material used shall normally be dry mulch of straw or hay, consisting of oat, rye, or wheat straw, or of pangola, peanut, Coastal Bermuda or Bahia grass hay. Only undeteriorated mulch, which can readily be cut into the soil, shall be used.

PART 3 - EXECUTION

3.01 PREPARATION

- A. See Section on Preparation of Ground, Section 02934, Article 3.01.

3.02 INSPECTION

- A. Verify that soil preparation and related preceding work has been completed.
- B. Do not start work until conditions are deemed satisfactory.

3.03 INSTALLATION

- A. Apply the lawn seed with a drop-type spreader while soil is still loose at the rate of eight (8) pounds per one thousand (1,000) square feet.

- B. Apply half the seed in one direction and the remainder at right angles to the first seeding.
- C. After applying, rake the seed into the seed bed to a depth of one-half inch.
- D. Approximately 2-inches, loose thickness, of mulch material shall be applied uniformly over the seed bed and cut into the soil so as to produce a loose mulched thickness of 3- to 4-inches. The area shall be rolled thoroughly with a lawn roller immediately after completion of the seeding and mulching.
- E. Water the seeded area lightly and again roll the area with a light lawn roller to assure firm contact of the soil and seed.

3.04 MAINTENANCE

- A. Soil should be kept continuously moist, but not too wet, until seed has germinated and become well established.
- B. The Contractor shall, at his expense, maintain the planted areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include watering, mowing, and filling, leveling, and repairing of any washed or eroded areas, as may be necessary. The Engineer may require replanting of any areas in which the establishment of the grass stand does not appear to be developing satisfactorily. Replanting shall be performed at the Contractor's expense except when it is determined that such replacement was due to circumstances beyond the Contractor's control.

3.05 CLEANING

- A. Immediately clean spills from paved and finished surface areas.
- B. Remove debris and excess materials from project site.

END OF SECTION

SECTION 02934

SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work specified in this Section consists of establishing a stand of grass, within the areas indicated on the Drawings, by furnishing and placing grass sod. Also included are fertilizing, watering and maintenance as required to assure a healthy stand of grass.

1.02 SUBMITTALS

- A. A certification of sod quality by the producer shall be delivered to the Engineer ten (10) days prior to use.

PART 2 - PRODUCTS

2.01 GRASS SOD

- A. Grass sod shall be Bahia or Bermuda grass and shall be well matted with grass roots. The sod shall be taken in rectangles or rolls, shall be a minimum 2 inches in thickness and shall be live, fresh and uninjured at the time of planting.
- B. It shall be reasonably free of weeds and other grasses and shall have a soil mat of sufficient thickness adhering firmly to the roots to withstand all necessary handling. The sod shall be planted as soon as possible after being dug and shall be shaded and kept moist until it is planted.

2.02 FERTILIZER

- A. Commercial fertilizer shall comply with the state fertilizer laws.
- B. The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid and (3) water-soluble potash contained in the fertilizer.
- C. The chemical designation of the fertilizer shall be 6-6-6. At least 50 percent (50%) of the nitrogen shall be derived from organic sources. At least 50 percent (50%) of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two (2) units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

2.03 WATER FOR GRASSING

- A. The water used in the sodding operations shall be obtained as provided for in Section 01500: Temporary Facilities.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND

- A. The area over which the sod is to be placed shall be scarified or loosened to a depth and then raked smooth and free from debris. Where the soil is sufficiently loose and clean, the Engineer, at his discretion, may authorize the elimination of ground preparation.

3.02 APPLICATION OF FERTILIZER

- A. Before applying fertilizer, the soil pH shall be brought to a range of 6.0 to 7.0.
- B. The fertilizer shall be spread uniformly over the area to be sodded at the rate of 700 pounds per acre, or 16 pounds per 1,000 square feet, by a spreading device capable of uniformly distributing the material at the specified rate. Immediately after spreading, the fertilizer shall be mixed with the soil to a depth of approximately 4 inches.
- C. On steep slopes, where the use of a machine for spreading or mixing is not practicable, the fertilizer shall be spread by hand and raked in and thoroughly mixed with the soil to a depth of approximately 2 inches.

3.03 PLACING SOD

- A. The sod shall be placed on the prepared surface, with edges in close contact and shall be firmly and smoothly embedded by light tamping with appropriate tools.
- B. Where sodding is used in drainage ditches, or on slopes of 4:1 or greater, the setting of the pieces shall be staggered so as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, the offsets of individual strips shall not exceed 6 inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.
- C. On slopes greater than 2 to 1, the Contractor shall, if necessary, prevent the sod from sliding by means of wooden pegs driven through the sod blocks into firm earth, at suitable intervals.

- D. Sod which has been cut for more than 72 hours shall not be used unless specifically authorized by the Engineer after his inspection thereof. Sod which is not planted within 24 hours after cutting shall be stacked in an approved manner and maintained and properly moistened. Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed and replaced by fresh, uninjured pieces.
- E. Sodding shall not be performed when weather and soil conditions are, in the Engineer's opinion, unsuitable for proper results.

3.04 WATERING

- A. The areas on which the sod is to be placed shall contain sufficient moisture, as determined by the Engineer, for optimum results. After being placed, the sod shall be kept in a moist condition to the full depth of the rooting zone for at least 2 weeks. Thereafter, the Contractor shall apply water as needed until the sod roots and starts to grow for a minimum of 60 days (or until final acceptance, whichever is latest).

3.05 MAINTENANCE

- A. The Contractor shall, at his expense, maintain the sodded areas in a satisfactory condition until final acceptance of the project. Such maintenance shall include repairing of any damaged areas and replacing areas in which the establishment of the grass stand does not appear to be developing satisfactorily.
- B. Replanting or repair necessary due to the Contractor's negligence, carelessness or failure to provide routine maintenance shall be at the Contractor's expense.

END OF SECTION

SECTION 02942

PIPE GASKETS FOR DRAINAGE PIPE

PART 1 - GENERAL

1.01 ROUND RUBBER GASKETS FOR PIPE

- A. Except where O-ring type gaskets are specified for special cases and for special type pipe, round rubber gaskets for use in concrete pipe joints shall meet the requirements of ASTM C 443, with the additional requirements that the gasket used shall be of such cross sectional area and perimeter as to properly fit the space provided in the pipe joint in which it is to be used.
- B. Prior to use, the gasket shall be stored in as cool a place as practicable.

1.02 PROFILE RUBBER GASKETS FOR CONCRETE PIPE JOINTS

- A. Round Pipe: The gaskets shall meet the requirements of ASTM C 443.
- B. Elliptical Pipe: The gaskets shall meet the requirements of ASTM C 443.
- C. Additionally, the gaskets used shall be of such cross sectional area and perimeter as to properly fit the space provided in the pipe joint in which it is to be used.
- D. The gaskets shall be stored in as cool a place as practicable prior to use.

1.03 RESILIENT CONNECTORS FOR SEALING PRECAST STRUCTURES TO PIPE JOINTS

- A. Resilient connectors shall meet the requirements of ASTM C 1478.
- B. The connectors shall also be compatible with the precast structure and pipe.

1.04 CERTIFICATION

- A. The manufacturer of the gasket material shall furnish the Engineer certified test results covering each shipment of material to each project.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work included in this Section consists of providing all labor, materials and equipment necessary for providing and installing formwork for concrete.
- B. Related Work Described Elsewhere:
 - 1. Concrete Reinforcement: Section 03200.
 - 2. Concrete Joints and Waterstops: Section 03262.
 - 3. Cast-in-Place Concrete: Section 03300.
- C. General Design and Responsibility:

Structural design responsibility: All forms and shoring shall be designed at the Contractor's expense by a Professional Engineer registered in the State of Florida. Formwork shall be designed and erected in accordance with the requirements of ACI 350 and as recommended in ACI 347, and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. The Contractor shall be responsible for safety in its construction and removal.

1.02 QUALITY ASSURANCE

- A. Qualifications: Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations. Where provisions of pertinent codes conflict with the requirements of this section of these specifications, the more stringent provisions shall govern.
- B. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:
 - 1. American Concrete Institute (ACI):
 - a. ACI 347 – Guide for Concrete Formwork.
 - b. ACI 350 – Environmental Engineering Concrete Structures.

- c. ACI 318 – Building Code Requirements for Reinforced Concrete.
 - 2. American Plywood Association (APA):
 - a. Material grades and designations as specified.
 - 3. Building Codes:
 - a. Standard Building Code (SBCCI)
 - b. Local Codes and Regulations.
- C. Pre-placement checklist: The Contractor, as part of his Quality Control Plan, shall develop and submit for approval, a Pre-placement Checklist form to cover the following items:
 - 1. Reference Drawings covering the placement for all trades and disciplines.
 - 2. Date and time scheduled for placement and the actual date and time of placement.
 - 3. Foreman name, placement number, number of truckloads, and number of cylinders.
 - 4. Checklist items such as embeds (list each), subgrade, rebar, forms, alignment, plumbness, etc.
 - 5. Signoff's for foreman, Contractor's Quality Control representative, each subcontractor foreman (major subs, mechanical, electrical, plumbing, etc.), and Engineer.
- D. No concrete may be placed until the checklist is properly and completely signed off. Failure to comply with this provision can be grounds for rejection of the work. The checklist shall be weather-protected and located with the foreman or at the foreman's station.

1.03 SUBMITTALS

- A. Submit Shop Drawings and product data in accordance with Section 01340, showing materials of construction and details of installation for:
 - 1. Location and sequence of the concrete placements. Indicate locations of joints and panel sizes and patterns. Show location of form ties on architectural surfaces.

2. Review of pour sequence, form system, and panel layout shall be for appearance and strength of the completed structure only. Review by the Engineer of forming plans or procedures shall not relieve the Contractor of responsibility for the strength, safety or correctness of methods used, the adequacy of equipment, or from carrying out the work in full compliance with the requirements of the Drawings and Specifications.

B. Samples:

1. The contractor shall demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated, or otherwise furnished and will not affect the forming materials.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Form Lumber: Use form lumber when in contact with exposed concrete, conforming to one (1) of the following, a combination thereof, or equivalent as approved by the Engineer.
1. Lumber: Southern Pine No. 2 grade, seasoned, surfaced on four (4) sides.
 2. Plywood: Shall be new and unused "Plyform," Class I or II, bearing the label of the American Plywood Association (minimum ¾-inch thickness).
 - a. All joints or gaps in forms shall be tapes, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging outward or creating surface patterns.
- B. Form Ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Use embedded rods with integral waterstops and cones to provide a 1½-inch breakback. Wire ties and wood spreaders will not be permitted.

C. Form Release Agent:

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water-based, bond-breaking form coating that leaves the concrete with a paintable surface unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non-toxic and free of taste or odor.

D. Chamfer Strips and Moldings: Chamfer strips shall be polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 1-inch chamfer (unless indicated otherwise) at exposed edges of concrete members. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealant manufacturer's recommendations.

E. Metal Forms: Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Construction of Formwork: Forms shall be sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete, and shall be sufficiently rigid to maintain specified tolerances. Forms shall be sufficiently tight to prevent loss of mortar, and shall be adequately braced against lateral, upward or downward movement.

B. Coating of Forms: Apply form coating to board forms prior to placing reinforcing. Keep form coatings off steel reinforcing, items to be embedded and previously placed concrete.

C. Form Erection:

1. Provide a means of holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects of the finished concrete. Insure that forms may be removed without injury to the surface of the finished concrete.
2. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.
3. Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 6-feet unless an elephant trunk is used. Such

openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8-feet apart. Temporary openings shall also be provided in the bottom of wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.

4. Do not embed any form-tying device or part thereof other than metal in concrete.
5. Form surfaces of concrete members except where placement of the concrete against the ground is shown on the drawings. The dimensions of concrete members shown on the Drawings apply to formed surfaces, except where otherwise indicated.

D. Formwork Reuse:

Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such a uniform texture. All surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, and all protrusions smoothed. Plug unused tie rod holes with corks, shave flush, and sandpaper on the concrete surface side. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

E. Metal Forms:

Metal forms shall be thoroughly cleaned, and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.02 Form Tolerances:

A. Concrete Tolerance:

1. Vertical, lateral, and level alignments, and cross-sectional dimensions shall comply with ACI 117.

2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

<u>Maximum Tolerance</u>	<u>(inches)</u>
Sleeves and Inserts	+1/4 to -1/4
Projected ends of anchors	+1/4 to 0.0
Anchor bolt setting	+1/4 to -1/4
Finished concrete, all locations	+1/4 to -1/4 per in. 10-feet of length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and Inserts	Centerline of sleeve or insert
Projected ends of anchors	Plane perpendicular to the end of the anchor as located on the Drawings
Anchor bolt setting	Centerline of anchor bolt
Finish Concrete	The concrete surface as located on the Drawings.

3. Where equipment is to be installed, comply with manufacturer's tolerances if more severe than above.

B. Form Tolerances:

1. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 347, and shall meet the following additional requirements for the specified finishes.
2. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in 4-feet. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-inch from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.
3. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.
4. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no

minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-inch.

5. Formed Concrete Surfaces to Receive Paint: Surface deflections shall be limited to 1/32-inch at any point and the variation in wall deflection shall not exceed 1/16-inch per 4-feet. The maximum deviation of the finish wall surface at any point shall not exceed ¼-inch from the intended surface as shown on the Drawings.
- C. Formed Openings: Openings shall be of sufficient size to permit final alignment of the items within it without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure water tightness around openings so formed. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated and specified. Reinforcing steel shall be at least 2-inches clear from the opening.
- D. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting.
- E. Pipes and Wall Spools Cast in Concrete:
 1. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall spools to the reinforcing steel.
 2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.

3.03 REMOVAL OF FORMS

- A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 350 and ACI 347. Form removal shall conform to the requirements specified in Section 03300, Cast-in-Place Concrete.

3.04 INSPECTION

- A. The Engineer shall be notified when the forms are complete and ready for inspection at least 6-hours prior to the proposed concrete placement.
- B. Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with requirements of these Specifications, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as approved by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of these Specifications and approval of the Engineer.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work in this Section consists of providing all labor, materials, equipment and incidentals required to install all steel bars, steel wire and wire fabric required for the reinforcement of concrete, as shown on the Drawings, and as specified herein.
- B. Related Work Described Elsewhere:
 - 1. Concrete Formwork: Section 03100.
 - 2. Concrete Joints and Waterstops: Section 03262.
 - 3. Cast-in-Place Concrete: Section 03300.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:
 - 1. American Concrete Institute (ACI)
 - a. ACI 117 – Standard Tolerance for Concrete Construction and Materials.
 - b. ACI 301 – Specifications for Structural Concrete.
 - c. ACI 318 – Building Code Requirements for Reinforced Concrete.
 - d. ACI 350R – Environmental Engineering Concrete Structures
 - e. ACI 315 – ACI Detailing Manual
 - 2. American Society for Testing and Materials (ASTM)
 - a. ASTM A82 – Specification for Steel Wire, Plain, for concrete Reinforcement.

- b. ASTM A184 – Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 - c. ASTM A185 – Specification for Steel Welded Wire Fabric, Plain, for concrete Reinforcement.
 - d. ASTM A496 – Specification for Steel Wire, Deformed, for Concrete Reinforcement
 - e. ASTM A497 – Specification for Welded, Deformed, Steel Wire Fabric for Concrete Reinforcement.
 - f. ASTM A615 – Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - g. ASTM A767 – Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - h. ASTM A775 – Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.
- 3. American Welding Society (AWS)
 - a. AWS D1.4 Structural Welding Code – Reinforcing Steel.
- 4. Concrete Reinforcing Steel Institute (CRSI)
 - a. CRSI Manual of Standard Practices.
- 5. Building Codes
 - a. Standard Building Code (SBCCI)
 - b. Local codes and regulations.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

- 1. Submit mill test certificates identifying chemical and physical analyses for each load of reinforcing steel delivered.
- 2. Submit shop drawings for review in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall include wall elevations, plan views, and sections to clearly show the

reinforcing placing procedures. Placing drawings shall indicate all openings (mechanical, electrical, equipment), including additional reinforcing at openings and intersecting wall, beam and footing arrangements as indicated on the structural drawings and specified herein. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, floor or beams), including all dowels and other bars as required. Furnishing such lists shall not be construed that the list will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Reinforcement shall be shipped to the work with bars of the same size and shape fastened in bundles with metal identification tags with waterproof markings giving size and mark securely wired on. The identification tags shall be labeled with the same designation as shown on the submitted bar lists and shop drawings.
- B. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete reinforcement in sizes No. 3 (3/8-inch) and larger shall be deformed steel bars of the same sizes and shapes indicated on the Drawings. The steel shall be newly rolled stock of domestic manufacture, substantially free from mill scale, rust, dirt, grease, or other foreign matter. Bars shall be of intermediate grade, deformed billet steel conforming to ASTM Specification A-615, Grade 60, including all supplementary requirements.
- B. Rail-steel bars will not be allowed in the work.
- C. Reinforcement shall be accurately fabricated to the dimensions indicated on the Drawings. Particular care shall be exercised not to have stirrups oversized in order to maintain proper coverage of concrete. Stirrups and tie bars shall be made around a pin having a diameter not less than two (2) times the maximum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than five (5) times the minimum thickness of the bar except for bars larger than 1-inch, in which case the bends shall be made around a pin of eight (8) bar diameters. All bars shall be bent cold. Bars reduced in section or with kinks or bends not shown on the Drawings, will not be accepted.

- D. Wire fabric shall conform to ASTM Specification A-185, galvanized for Welded Steel Wire Fabric for Concrete Reinforcement. Welded wire fabric shall be furnished in flat sheets; rolled WWF is not permitted.
- E. Wire tie shall be 16-gauge minimum, zinc coated annealed, conforming to ASTM Specification A-82.
- F. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.
- G. Coupler Splice Devices: Tension couplers capable of developing the ultimate strength of the bar as manufactured by Erico Products Inc., Solon, Ohio, or equal and where approved by the Engineer.
- H. Reinforcing Steel Accessories:
 - 1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 – Maximum Protection.
 - 2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 – Moderate Protection
 - 3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the CRSI. The CONTRACTOR shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.
- B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:
 - 1. Concrete cast against and permanently exposed to earth, soil, water, sewage, or weather: 3-inches.
 - 2. Concrete not exposed to soil, water, sewage, or weather:
 - a. Slabs (top and bottom cover), walls and joists: $\frac{3}{4}$ -inch.

- b. Beams and columns (principal reinforcement, ties, spirals, and stirrups) 1-1/2 inch.
- C. Reinforcement, which will be exposed for a considerable length of time after being placed, shall be coated with a heavy coat of neat cement slurry.
- D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified, or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.
- E. Reinforcing steel interfering with the location of other reinforcing steel, conduits, or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.
- F. Securely support and tie reinforcing steel to prevent movement during concrete placement by using zinc-coated wire ties of not less than No. 16 gauge or suitable clips at intersections. Secure dowels in place before placing concrete.
- G. Do not press dowels into the concrete after the concrete has been placed.
- H. Flat sheet wire mesh shall be placed as follows. Support and tie mesh to prevent movement during concrete placement. Support welded wire fabric by high chairs, or bolster with baseplates, all plastic supports, and concrete blocks. It is not permissible to place the WWF on the subbase; pulling it up or laying the WWF on top of the concrete and walking it into the concrete. Extend fabric to within 2-inches of the edges of the slab and lap splices at least 1-1/2 courses of the fabric and a minimum of 6-inches. Tie laps and splices securely at ends and at least every 24-inches with 16 gauge annealed steel wire.
- I. Reinforcing steel bars shall not be field bend except where shown on the Drawings, or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld, or otherwise repair as approved by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

- A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one-half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

2.03 SPLICING OF REINFORCEMENT

- A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30-bar diameters, but not less than 12-inches. The lap splice length for column vertical bars shall be based on the bar size in the column above.
- B. Tension lap splices shall be provided at all lap in compliance with the applicable tables in the ACI 315. Splices in adjacent bars shall be staggered. Class A splices shall be used when 50 percent or less of the bars are splices within the required lap length. Class B splices shall be used at all other locations.
- C. Except as otherwise indicated on the Drawings, splices in circumferential reinforcement in circular walls shall be Class B tension splices and shall be staggered. Adjacent bars shall not be spliced within the required lap length.
- D. Install wire fabric in as long lengths as practical. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI 318, but not less than 12-inches. The spliced fabrics shall be tied together with wire ties spaced not more than 24-inches on center, and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

3.04 ACCESSORIES

- A. The Contractor shall be solely responsible for determining, providing, and installing accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic-tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified.

- D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom, steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

2.04 INSPECTION

- A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement, has been observed by the Engineer, and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given at least 24-hours advance notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his observations of the reinforcing steel.

END OF SECTION

SECTION 03262

CONCRETE JOINTS AND WATERSTOPS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included in this section consists of providing all labor, materials and equipment necessary to install expansion joints, construction joints, and waterstops.
- B. Related Work Described Elsewhere:
 - 1. Concrete Formwork: Section 03100.
 - 2. Concrete Reinforcement: Section 03200.
 - 3. Cast-in-place Concrete: Section 03300.

1.02 SUBMITTALS

- A. Materials: Submit manufacturer's literature, materials and samples of waterstops in accordance with Section 01340: Shop Drawings, Working Drawings and Samples including a statement of compliance with ASTM and U.S. Federal Specifications. Manufacturer shall demonstrate five (5) years, minimum, of continuous, successful experience in their product line.
 - 1. Waterstops: Product data including catalog cut, technical data, storage requirements, splicing methods, and conformance to ASTM standards.
 - 2. Premolded joint fillers: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.
 - 3. Bond breaker: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.
 - 4. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformance to ASTM standards.

5. Compressible joint filler: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.
6. Bonding agents: Product data including catalog cut, technical data, storage requirements, product life, application requirements, and conformance to ASTM standards.

B. Certifications

1. Certification from the manufacturer that all materials used within the joint system are compatible with each other.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. A615 - Dowel Bars, Plain Steel
2. ASTM C881 - Epoxy-Resin-Base Bonding Systems for Concrete.
3. ASTM C1059 - Latex Agnets for Bonding Fresh to Hardened Concrete.
4. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
5. ASTM D1752 - Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction.

B. U.S. Army Corps of Engineers (CRD)

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store all products under tarps to protect from oil, dirt and sunlight.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The use of manufacture's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

- B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility.

2.02 MATERIALS

- A. Waterstops: Waterstops shall be extruded from a PVC compound and shall be 9-inches by 3/8-inch non-tapered, ribbed profile as shown on the Drawings. Corners, tees, and crosses shall be supplied by factory. Waterstops shall comply with Corps of Engineers Specification CRD-C-572. All material shall be virgin material. The uses of reworked PVC or other substitute will not be permitted. Natural color, off white, milky color.
- B. Premolded Joint Filler
 - 1. Premolded joint filler - structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752 Type III. The thickness shall be 3/4-inch unless otherwise shown on the Drawings.
 - 2. Premolded joint filler - sidewalk and roadway concrete pavements. Joints where fiber is specifically noted on the Drawings, shall be asphalt-impregnated fiberboard. Joint filler shall conform to ASTM D1751. Thickness shall be 3/4-inch unless otherwise shown on the Drawings.
- C. Bond Breaker
 - 1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape that will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
 - 2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a non-staining type bond prevention coating.
- D. Expansion Joint Dowel
 - 1. Dowels shall be smooth steel conforming to ASTM A615, Grade 60. Dowels must be straight and clean, free of loose flaky rust and loose scale. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end.

E. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type V.
2. Latex bonding agent shall be a non-reemulsifiable acrylic-polymer latex conforming to ASTM C1059 Type II.

F. Compressible Joint Filler

1. The joint filler shall be non-extruded watertight strip materials use to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70-hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first one-half hour after unloading. Compressible Joint filler shall be Evasote 380 E.S.P., by E-Poxy Industries, Inc., Ravena, NY, or equal.

G. Joint Sealant

1. Joint sealant for continuous immersion shall be a multi-part, gray, polyurethane sealant meeting U.S. Federal Specification TT-S-00227E (3) Type I, Class A for horizontal joints, and Type II, Class A for vertical joints. Additionally, the sealant must be recommended by the manufacturer for continuous immersion in water.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Construction Joints:

1. Provide construction joints where shown on the Drawings, or as recommended by the Contractor and approved by the Engineer. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)
2. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the Drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25 percent of the area of the section.
3. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint. Embed dowels 48-bar diameters each side of the joint. Size and number of dowels shall match reinforcing

in the member. Furnishing and placing such reinforcing steel shall be at the Contractor's expenses.

4. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. At least two hours before and again shortly before the new concrete is deposited, the joints shall be dampened, but not saturated. After glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-inch thick, well scrubbed-in by means of stiff bristle brushes whenever possible. New concrete shall be deposited before the neat cement dries.

B. Expansion Joints:

1. Provide expansion joints of sizes and at locations as shown on the Drawing.
2. Place expansion joint fillers every 30-feet in straight runs of walkways, at right angles turns and wherever concrete butts into vertical surfaces.

C. Time Between Pours: At least 2-hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders or slabs supported thereon. Place beams, girders, brackets, column capitals and haunches monolithically as part of the floor or roof system.

D. Joint Sealants: Joint sealants shall be required where indicated on the Drawings. Preparation of surfaces, priming and the handling and preparation of materials shall be in complete compliance with the manufacture's instructions as approved.

E. Waterstops:

1. Waterstops shall be properly heat spliced at ends and intersections to ensure continuity. Construct forms for construction joints in such a manner as to prevent injury to waterstops. Installed waterstops in construction joints in hydraulic structures that will contain liquid or resist the entry of groundwater.
2. Make field splices with a thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80 percent of the unspliced materials.

3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12-inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.
4. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.
- B. Related Work Described Elsewhere:
 - 1. Concrete Formwork: Section 03100.
 - 2. Concrete Reinforcement: Section 03200.
 - 3. Concrete Joints and Waterstops: Section 03262.
 - 4. Painting: Section 09900.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:
 - 1. American Concrete Institute (ACI)
 - a. ACI 301 - Specifications for Structural Concrete.
 - b. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - c. ACI 305 - Hot Weather Concreting.
 - d. ACI 306 - Cold Weather Concreting.
 - e. ACI 308 - Standard Practice for Curing Concrete.
 - f. ACI 309 - Guide for Consolidation of Concrete.
 - g. ACI 318 - Building Code Requirements for Reinforced Concrete.
 - h. ACI 347 - Guide for Concrete Formwork.

- i. ACI 350 - Environmental Engineering Concrete Structures.
- 2. American Society for Testing and Materials (ASTM)
 - a. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
 - b. ASTM C33 - Concrete Aggregates.
 - c. ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens.
 - d. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - e. ASTM C94 - Standard Specification for Ready-mix Concrete.
 - f. ASTM C143 - Slump for Portland Cement Concrete.
 - g. ASTM C150 - Standard Specification for Portland Cement.
 - h. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
 - i. ASTM C173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.
 - j. ASTM C231 - Air Content of Freshly Mixed Concrete by the Pressure Method.
 - k. ASTM C260 - Air Entraining Admixtures for Concrete.
 - l. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
 - m. ASTM C494 - Chemical Admixtures for Concrete.
 - n. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

3. Building Codes
 - a. Standard Building Code (SBCCI).
 - b. Local Codes and Regulations.
- B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C-94.
- C. Evaluation And Acceptance Of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.
 1. Watertightness

All structures to contain wastewater or water shall be watertight and shall be free from any perceptible leakage, as determined by the Engineer.

1.03 SUBMITTALS

- A. Materials and Shop Drawings: The following information shall be submitted for approval in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. No concrete shall be furnished until submittal has been approved.
 1. Plant Qualification: Satisfactory evidence shall be submitted indicating compliance with the specified qualification requirements.
 2. Materials: Satisfactory evidence shall be submitted indicating that materials to be used, including cement, aggregates and admixtures, meet the specified requirements. Provide catalog data, chemical and mechanical analysis, and conformance with ASTM requirements.
 - a. Sources of cement, pozzolan and aggregates.
 - b. Air-entraining admixture.
 - c. Water-reducing admixture.
 - d. High range water-reducing admixture (plasticizer).
 - e. Sheet curing material.
 - f. Liquid curing compound.
 3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for approval. The design of the mix is the

responsibility of the Contractor subject to the limitations of the Specifications. Approval of this submission will be required only as minimum requirements of the Specifications have been met. Such approval will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.

4. Ready Mix Concrete: Provide delivery tickets or Weighmaster's certificate per ASTM C-94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. Write in the amount of water added on the job.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C-150 Type I, Type II, or Type III. All sanitary sewer manholes, wet wells, pumping stations, and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the approval of the Engineer. Type I cement may be used for buildings and tremie concrete.
2. Only one brand of cement shall be used in any individual structure unless approved by the Engineer. Cement, which has become damaged, partially set, lumpy or caked, shall not be used and the entire contents of the sack or container containing such cement will be rejected. No salvaged or reclaimed cement shall be used.

B. Pozzolan

1. Fly ash shall be Class C or F conforming to the requirements of ASTM C-618, including the requirements of Table 1, except the loss of ignition, (LOI), shall be limited to 3 percent maximum. Fly ash shall not exceed 20 percent of the cementitious content of the mix.

C. Aggregates

1. ASTM C-33. Coarse aggregates shall be size No. 67 (3/4-inch). Block cell fill shall be size No. 8.
2. In addition to requirements of ASTM C-33 for structures exposed to wastewater, the following shall apply:
 - a. Soft particles: 3.0 percent (3%).
 - b. Chert as a soft impurity (defined in Table 3 of ASTM C-33): 2.0 percent (2%).
 - c. Total of soft particles and chert as a soft impurity: 5.0 percent (5%).
 - d. Flat and elongated particles (long dimension greater than 5-times short dimension): 15.0 percent (15%).

D. Water: Clean and free from injurious amounts of deleterious materials.

E. Air Entraining Admixture: ASTM C-260.

F. Water Reducing and Retarding Admixtures:

1. For concrete without superplasticizer: ASTM C-494, Type D, and shall contain no calcium chloride by weight of cement.
2. For concrete with superplasticizer
 - a. ASTM C-494, Type F or G. The admixture shall be a second generation type, free of chlorides and alkalis (except for those attributable to water) and composed of a synthesized sulfonated complex polymer. The concrete shall be capable of maintaining its rheoplastic state in excess of 2-hours if necessary. Superplasticizers admix shall be induced at the batch plant only, job site redosage shall not be permitted without prior approval from the Engineer.
 - b. Approved Materials:
 - (1) Rheobuild 716 as manufactured by MAC-USA, Inc., Boca Raton, Florida, or Rheobuild 716 as manufactured by Master Builders Technologies, Cleveland, Ohio.

- (2) Daracem 100 as manufactured by W.R. Grace & Co. Construction Products Division, Pompano Beach, Florida.
 - c. Manufacturer's job site representation: A competent field service representative from the manufacturer of each of the admixtures (superplasticizer) selected for use shall be available at the job site to provide advice and consultation on the use of the admixture materials, including the effect on the concrete in place. The representative shall be available on short call at any time requested by the Owner, Contractor, or concrete producer.
 - d. Manufacturer's representative will be responsible to recommend maximum discharge time for superplasticizer and to recommend method and procedure to induce superplasticizer into mixer.
 - e. Manufacturer's representative will be responsible to recommend quantities of admixtures to be used if variations are required because of temperature/humidity, wind, or other environmental considerations.
 - f. Concrete with superplasticizer shall be used for all cast in-place walls of structures.
- G. Curing compound: ASTM C-309, Type 1. The compound shall contain no ingredient that will adversely affect the bond of coatings or toppings. Curing compound shall be approved for use in contact with potable water after 30-days.
- 1. Curing compound for exposed concrete not to receive special finishes, protective coatings and/or concrete toppings shall be "Super Rez-Seal," as manufactured by Euclid Chemical Co., Cleveland, Ohio, or equal.
 - 2. Curing compound for exposed concrete to receive special finishes, protective coatings and/or concrete toppings shall be "Kurez-DR," as manufactured by Euclid Chemical Co., Cleveland, Ohio, or equal.
- H. Mortar for Repair of Concrete: Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one (1) part cement to two and one-half (2-1/2) parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.
- I. Burlap Mats: Conform to AASHTO Specification M-182.
- J. Epoxy Bonding Agent: Sikadur 32 Hi Mod, or equal.

2.02 MIXES

A. General Requirements:

1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI-318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special approval by the Engineer. Concrete mix design shall comply with the Standard Building Code requirements.
2. Air Content: Range 3.5 to 6% for Class A and B.
3. Slump: 4-inches plus or minus 1-inch for Class A and B without superplasticizer.

8-inches plus or minus 1-inch for concrete with superplasticizer.

6-inches plus or minus 1-inch for tremie concrete.
4. Water cement ratio = 0.45 (Class A Concrete) without superplasticizer.

= 0.45 (Class B Concrete) without superplasticizer.

= 0.37 Concrete with superplasticizer.
5. Minimum Compressive Strength at 28 days:
 - a. Class A, 4,000 psi: Wastewater structures inclusive of mat foundations, footings, tanks, ditches, pumping station, tremie concrete and other structures in contact with treated waters.
 - b. Class B, 4,000 psi: Slab on grade, masonry fillcell grout, encasements, thrust blocks, and pipe supports, concrete curbs, fills and sidewalks, etc. not in contact with treated waters.
 - c. Slab on grade shall include all slabs 10-inches thick or less, and requires Class B 4,000 psi concrete.

B. Production of Concrete:

1. General: Concrete shall be ready mixed and shall be batched, mixed, and transported in accordance with ASTM C-94, except as otherwise indicated.

2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water.
 3. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be separate from the air entraining admixture. The addition of the admixture shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendation of ASTM C-94.
- C. Delivery Tickets: In addition to the information required by ASTM C-94, delivery tickets shall indicate the cement content and the water/cement ratio.
- D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 95 degrees Fahrenheit (°F), otherwise ice shall be used to reduce the temperature of the concrete as recommended by ACI.
- E. Modifications To The Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water-cement ratio beyond that specified. No modifications of any kind shall be made except by a qualified and responsible representative of the concrete producer.
1. Any addition of water must be approved by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket. Addition of water shall follow procedures of ASTM C-94 for slump adjustment.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Preparations Before Placing: No concrete shall be placed until the approval of the Engineer has been received. Approval will not be granted until forms are thoroughly clean, and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The Engineer shall be notified a minimum of 24-hours before concrete is placed.
- B. Conveying:
 - 1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90-minutes after mixing has begun for that particular batch.
 - 2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area, or five (5) times the maximum aggregate size being used. Side slopes shall be no less than 60 degrees. Controls on gates shall permit opening and closing during the discharge cycle. It is suggested the Contractor provide one (1) standby bucket and hopper for use in case of equipment failure.
 - 3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.
 - 4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete for more than 6-feet.
 - 5. Chutes: Chutes shall be steel or steel-lined, and shall have a slope not exceeding one vertical to two horizontal, and not less than one vertical to three horizontal. Chutes more than 20-feet long and chutes not meeting the slope requirements, may be used only if they discharge into a hopper before distribution.
 - 6. Pumping Equipment: Pumping equipment and procedures, if used, shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2 inches.

7. Conveying Equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer, shall not be permitted.
8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Concrete shall be deposited continuously, or in layer of such thickness (not exceeding 2-feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least 2-hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures that will cause segregation.
4. Concrete Under Water: All concrete, except that indicated on the Drawings as Tremie concrete, shall be placed in the dry.
5. Concrete Fill and Tank Bottom Slab: Concrete fill for the tank bottoms, where shown on Drawings, shall be placed within the tolerances described in this Section and as per equipment manufacturer's recommendations

B. Seals and Tremie Concrete:

1. General:
 - a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.
 - b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which

subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.

2. Method of Placing: Concrete deposited under water shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than one cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in one (1) continuous pour. No concrete shall be placed in running water. All form work designed to retain concrete under water shall be watertight, and the design of the form work and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.
3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of 10-inches, and shall be constructed in sections having tight joints. No aluminum parts, which have contact with the concrete, will be permitted. The discharge end shall be entirely seated at all times and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous and in no case shall be interrupted until the work is completed. Special care shall be exercised to maintain still water at the point of deposit.
4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.
5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72-hours after placement of the concrete.

C. Consolidating Concrete:

1. General: Concrete, with the exception of slabs less than 8-inches thick, shall be consolidated by means of internal vibrators operated by competent workmen.
 - a. Concrete Slabs: Concrete for slabs less than 8-inches shall b consolidate with vibrating screeds: slabs 8-inches to 12-inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.
 2. Vibrators: Vibrators shall have a minimum head diameter of at least 2-inches, a minimum centrifugal force of 700, and a minimum frequency of 8,000 vibrations per minute.
 3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2 inches, a minimum centrifugal force of 300 pounds, and a minimum frequency of 9,000 vibrations per minute.
 4. Spare Vibrator: One (1) spare vibrator for each three (3) in use shall be kept on the site during all concrete placing operations.
 5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18-inches apart. The duration of each insertion shall be from 5 to 15 seconds. Concrete shall not be transported in the forms by means of vibrators.
- D. Protection: Rainwater shall not be allowed to increase the mixing water, or to damage the surface finish. Concrete shall be protected from construction overloads. Design loads shall not be applied until the specified strength has been attained.
- E. Construction Joints: Except as otherwise indicated on the Drawings, horizontal construction joints shall be provided at top of foundation members and slabs on grade and at the soffit of supported slabs and beams. Other horizontal and vertical construction joints shall be located as indicated on the Drawings. Joints will not be permitted except in the locations shown, unless recommended by the Contractor and approved by the Engineer.
- F. Bonding: Before depositing new concrete on or against concrete that has set, the surfaces of the set concrete shall be thoroughly cleaned so as to expose the coarse aggregate and be free of laitance, coating, foreign matter and loose particles. Forms shall be retightened. The hardened concrete of joints shall be dampened, but not saturated, and then thoroughly covered with a coat of cement grout of

similar proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least ½-inch thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

G. Embedded Items: In addition to steel reinforcement, pipes, inserts and other metal objects as shown, specified or ordered shall be built into, set in or attached to the concrete. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before concrete is placed, care shall be taken to determine that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. No wood shall be embedded in concrete. The concrete shall be packed tightly around pipes and other metal work to prevent leakage and to secure proper adhesion. Drains shall be adequately protected from intrusion of concrete.

H. Concrete Finishes: Complete concrete surfaces in accordance with the following schedule:

1.	Finish	
	Designation	Area Applied
	F-1	Exterior walls below grade not exposed to water. Repair defective concrete, fill depressions deeper than ½-inch and fill tie holes.
	F-2	Exterior and interior walls of all structures. Repair defective concrete, remove fins, fill depressions and fill tie holes.
	F-3	Walls of all structures or buildings exposed to public view and the underside of formed floors or slabs that will not be finish coated or sealed. In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry within 72-hours of removing forms consisting of one part cement and one and one-half parts sand by volume on the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
	F-4	Walls of all structures and buildings exposed to public view and the underside of formed floors or slabs that will be finish coated in accordance with Section 09900 - Painting. In addition to Finish F-2, surfaces shall be sand blasted and holes patched and depressions and airholes filled with a patching compound consisting of sand, portland cement and a liquid, acrylic-polymer bonding additive. Refer to

Section 09900 - Painting, for concrete surface preparation requirements.

- S-1 Slabs and floors not water bearing. Smooth steel trowel finish.
 - S-2 Slabs and floors which are water bearing. Slab Surfaces on which mechanical equipment moves. Steel trowel finish free from trowel marks and all irregularities.
 - S-3 Slabs and floors of structures or building exposed to view. Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
 - S-4 Slabs and floors at slopes greater than 10 percent. Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines perpendicular to the direction of slope drainage.
 - E-1 Exposed edges of slabs, floors and tops of walls. Finish with a ¼-inch radius edge if a chamfer is not indicated.
 - E-2 Tops of walls, beams and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of formed surfaces.
2. General: As soon as forms can safely be removed, all irregular projections shall be chipped off flush with the concrete surfaces. All voids produced by spacers or any honeycombing shall be pointed up with grout and troweled flush with the concrete surface immediately after removal of forms, and water cured to prevent shrinkage. Honeycombing shall be cut out to expose a sound concrete surface prior to pointing. The use of mortar pointing or patching shall be confined to the repair of small defects in relatively green concrete. Where in the opinion of the Engineer substantial repairs are required, the defective concrete shall be cut out to sound concrete and repaired with gunite or the concrete shall be removed and reconstructed as directed.
3. All concrete slabs to be troweled shall receive a floated finish. After floating, all concrete slabs except as otherwise indicated and in areas to receive roofing, insulation, tile or topping shall be troweled and immediately light broom finished. Stair treads shall receive a light broomed finish.

4. Floated Finish: After concrete has been placed. Consolidated, struck off and leveled, it shall not be worked further until water sheen has disappeared and the surface has hardened sufficiently to permit floating, the planeness of the slab shall be checked with a 10-foot straightedge applied at no less than two (2) angles. All high spots shall be cut down and all low spots shall be filled to produce a surface having a Class B Tolerance throughout. The slab shall then be refloated to a uniform sandy texture.
 5. Light Broomed Finish: After floating, slabs to receive a light broomed finish shall be power troweled and finished struck with a soft broom rag. The troweling shall produce a smooth surface, relatively free of defects and a Class B Tolerance. Before the surface sets, the soft broom drag shall be passed over the surface to produce a surface uniform in texture and appearance.
 6. Troweled Finish: After floating, slabs to receive a troweled finish shall be power troweled and finally hand troweled. The first troweling after power floating shall produce a smooth surface, relatively free of defects. Surfaces shall be hand troweled after the surface has hardened sufficiently. The final troweling shall be done by hand when a ringing sound is produced as the trowel is moved over the surfaces. Hand troweling shall produce a surface which is thoroughly consolidated, free from trowel marks, uniform in texture and appearance and plane to a Class B tolerance.
 7. Finishing Tolerance: Surfaces shall be true planes within the following limits:
 - a. Class B: $\frac{1}{4}$ -inch in 10-feet is determined by a 10-foot straightedge placed anywhere on the slab in any direction.
- I. Saw cut Joints: Joints that are to be saw cut shall be cut not sooner than 2 hours after the concrete is poured, and not later than 8 hours after the pour.

3.03 PROTECTING

A. Curing:

1. All exposed surfaces, including slabs, walls, beams and columns shall receive a spray coat of curing compound applied in accordance with the manufacturer's recommendations. Exposed steel keyways and other embedded items shall be protected from the curing compound. Concrete surfaces to be exposed to wastewater are to be coated with an epoxy system, and shall be cured by the wet burlap method. Curing compounds shall not be used on surfaces to be coated and exposed to sewage or wastewater.
2. Curing compound shall be uniformly applied to the surfaces to be cured, in a single-coat, continuous film by a mechanical sprayer. Application shall be in compliance with the manufacturer's recommendations.
3. Curing compound shall be applied in accordance with manufacturer's instructions. Should the film become damaged from any cause within the repaired curing period, the damaged portions shall be required immediately with additional compound. Upon removal of forms, the newly exposed surfaces shall immediately be coated to provide a curing treatment equal to that provided for the surface.

- B. Wet Burlap Curing Method: All concrete for wastewater/water retaining structures are to be cured by the wet burlap method. All concrete shall be covered with a double thickness of burlap, cotton mats, or other approved material kept thoroughly saturated with water. The forms shall be kept wet until removed and upon removal, the curing specified herein shall be started immediately. Concrete shall be cured for a period of 7-days for normal Portland cement or 4-days for high early strength cement. Concrete poured in the dry shall not be submerged until it has attained sufficient strength to adequately sustain the stress involved, nor shall it be subjected to flowing water across its surface until it has cured 4 days. Curing the gunite shall be started as soon as possible without damaging surface and not later than 2-hours after placing. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

3.04 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 70 percent of the 28-day compressive strength prescribed by the design, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 4

<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls and vertical surfaces	100

- B. Shores shall not be removed until the concrete has attained at least 60 percent of the specified strength and also sufficient strength to support safely its own weight and the construction live loads upon it.

3.05 TESTING

- A. An independent testing laboratory employed by the Contractor will make such tests as required.
- B. Standard laboratory compressive test cylinders will be obtained by the laboratory when concrete is discharged at the point placing (i.e., discharge end of pumping equipment), and cylinders will be made and cured in accordance with the requirements of ASTM Designation C-31. A set of five (5) cylinders will be obtained for each 50 cubic yards, or fraction thereof placed each day, nor less than once for each 5,000 sq. ft. or surface area of slabs or walls for each type of concrete. The cylinders will be cured under laboratory conditions and will be tested in two groups of two (2) at 7 and 28 days of age, with one (1) group held until released by the Engineer in accordance with the requirements of ASTM Designation C-39.
- C. The laboratory will conduct tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests will be made for each truckload of concrete. Slump tests may be made on any batch, and failure to meet specified slump requirements will be sufficient cause for rejection of the batch. If water is added after initial test then the "load" shall be tested.
- D. Air content of the concrete mixture will be tested on every other truck in accordance with ASTM C173 or ASTM C231.

- E. Historical strength/break data may be submitted with mix design and may be used in the approval process provided the mix design is otherwise acceptable. If the mix design required modifications, a test batch may still be required.

3.06 FIELD CONTROL

- A. The Contractor shall advise the Engineer of his readiness to proceed at least 24 working hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Engineer.
 - 1. The Contractor's Superintendent shall submit a certification that indicates preparedness to place concrete and is in accord with contract drawings and specifications. This certification shall be submitted on forms provided by the Engineer.
- B. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of test on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.
- C. The Contractor shall cooperate in obtaining cores by allowing free access to the Work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The Contractor shall repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

3.07 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and testing in compliance with the previous provisions fall below the values given in Section 2.02.A.5, the Engineer shall have the right to require changes in proportions outlined to apply on the remainder of the Work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens that failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In cases of failure to meet strength requirements the Contractor shall adjust the concrete mix to meet contract requirements.
- B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by means of typical

cores drilled from the structure in compliance with ASTM C42 and C39. In case of failure of the core, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days.

- C. Should the strength of test cylinders fall below 85 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

3.08 PATCHING

- A. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defect which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.
- B. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100-Concrete Formwork. Holes are then to be promptly filled upon stripping as follows: Moisten the hole with water, followed by a 1/16-inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch. Compact the grout into the hole until dense and an excess of paste appears on the surface. Trowel smooth with heavy pressure. Avoid burnishing.
- C. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine carborundum stone at an age of one to five days if necessary to bring the surface down to the adjacent concrete. Exercise care to avoid damaging or staining the surrounding concrete. Wash thoroughly to remove all rubbed matter.

3.09 REPAIRS

- A. It is the intent of these Specifications to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will not require patching.
- B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified.
 - 1. General: Surface defects, including tie holes shall be repaired immediately after form removal. The areas to be patched and an area at least 6-inches wide surrounding it shall be dampened to prevent

absorption of water from the patching mortar. The Engineer shall be notified prior to commencing operations.

2. Removal of Defective Concrete: All honeycombed and other defective concrete shall be removed down to sound concrete. Edges shall be cut perpendicular to the surface or slightly under cut. Sand blast surfaces to receive repair.
3. Bonding Grout: Surfaces to be patched shall be thoroughly dampened and shall receive a coat of bonding grout brushed into the surface. Grout shall consist of one part cement to one part fine sand passing a No. 30 sieve. Grout shall be the consistency of thick cream.
4. Placing Patching Mortar: After the bonding grout begins to lose its water sheen, a premixed patching mortar shall be applied. Patching mortar shall be thoroughly consolidated into place and stuck off so as to leave the patch slightly higher than the surrounding surface. It shall be left undisturbed for one hour to permit initial shrinkage, and then finally finished.
5. Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.

3.10 MISCELLANEOUS WORK

- A. All bolts, anchors, miscellaneous metals or other sleeves and steelwork required to be set in the concrete forms for attachment of masonry, structural, and mechanical equipment shall be set or installed under this Section. The Contractor shall be fully responsible for the setting of such materials in the forms and shall correct all such not installed in a proper location or manner at his own expense. Contractor shall coordinate the activities of other trades for installation of these items.
- B. Electric conduits shall be installed in the concrete as required by the Drawings and specified elsewhere in these Specifications. Outlet boxes and fixtures shall be located in reference to the final floor, wall or ceiling finish, and shall be as secured that they will not be displaced by concrete placing.
- C. Pipes or conduits for embedment, other than those merely passing through, shall not be larger in outside diameter than one-third the thickness of the slab, wall, or beam in which they are embedded, unless indicated on the Drawings, nor shall they be spaced closer than three (3) diameters on center, nor so located as to unduly impair the strength of the construction. The Engineer shall approve the location of all conduits and fixtures.

- D. Concrete foundations, supports and bases for all equipment and machinery shall be built to the equipment manufacturer's requirements, as approved by the Engineer, with anchor bolts installed.

END OF SECTION

SECTION 03410

PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work under this Section includes the design, casting, delivery, and erection of precast concrete structures as indicated on the Drawings.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the current editions of the following standards:
 - 1. Standard Building Code.
 - 2. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 3. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.

1.03 SUBMITTALS

- A. The following information shall be submitted to the Engineer for approval in accordance with Section 01340. Fabrication shall not begin until submission has been approved.
 - 1. Quality Control: Satisfactory evidence shall be submitted that plant and production methods meet the requirements of PCI MNL 116.
 - 2. Design: Complete calculations including shear, moment, buoyancy, and camber shall be submitted. All computation sheets shall bear the seal of a Professional Engineer registered in the State of Florida. Design water table shall be assumed to be at finished grade.
 - 3. Shop Drawings: Complete fabrication and erection drawings shall be submitted. All drawings shall bear the seal of a Professional Engineer registered in the State of Florida.

B. Manufacturer's data sheets shall be submitted on the following:

1. Joint mastic and gaskets.
2. Pipe connections.
3. Grout material.
4. Hatches and manhole covers.

1.04 DELIVERY, STORAGE AND HANDLING

A. Transportation and erection shall be done by qualified personnel using proper equipment. Lifting and supporting shall be done only at points indicated on the shop drawings.

1.05 MANUFACTURERS

- A. Mack Precast Corporation;
- B. Hanson Pipe and Precast;
- C. Volusia Precast; or
- D. Approved equal.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Precast Concrete Structures:

1. Design loads shall consist of dead load, live load, impact, soil loads and loads due to water table, as well as other loads which may be imposed upon the structure. Wetwells and manholes shall be designed in accordance with ASTM C-478. The wall thicknesses for wetwells, valve vaults and manholes shall be as shown on the Drawings.
2. Forms used for precast concrete shall be of metal, and sufficiently designed and braced to maintain their alignment under pressures of the concrete during placing. Base and first section of precast structures shall be an integral cast.
3. Aggregates. All aggregates, fine and coarse, other than lightweight aggregate shall conform to ASTM C-33. Lightweight aggregates, fine and

coarse, shall conform to ASTM C-330. Aggregates shall be free of deleterious substances causing reactivity with oxidized hydrogen sulfide.

Both types of aggregate shall be graded in a manner so as to produce a homogenous concrete mix. All materials are to be accurately weighed at a central batching facility for mixing.

4. Cement shall be Portland cement Type II.
5. Minimum compressive strength of concrete used for precast concrete structures shall be 4,000 psi at 28 days.
6. Placing. All concrete shall be handled from the mixer or transport vehicle to the place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients, until the approved unit is completed. Maximum elapsed time from batching to placement shall be 2 hours. Concrete shall be placed in layers not over 2-feet deep. Each layer shall be compacted by mechanical internal or external vibrating equipment. Duration of the vibration cycle shall be limited to the time necessary to produce satisfactory consolidation without causing objectionable segregation.
7. Curing:
 - a. For purposes of early reuse of forms, precast concrete may be steam-cured after an initial set has taken place. The steam temperature shall not exceed 160°F, and the temperature shall be raised from normal ambient temperatures at a rate not to exceed 40°F per hour.
 - b. The steam cured unit shall not be removed from the forms until sufficient strength is obtained for the unit to withstand any structural strain to which it may be subjected during the form stripping operation. After the stripping of forms, further curing by means of water spraying or a membrane curing compound may be used, and shall be of a clear or white type, conforming to ASTM C-309.
8. Reinforcing steel shall be sufficiently tied to withstand any displacement during the pouring operation. All bars shall be Grade 60.
9. Joints shall be tongue and groove pipe ends sealed with round or other flexible type natural rubber joint ring gaskets in conformance with ASTM C-433 or by a flexible preformed bitumastic sealing material equal to Ram-Nek as manufactured by R.K. Snyder and Co., Houston, Texas. If rubber joint ring gaskets are used, interior and exterior voids in the pipe

joints shall be sealed with flexible sealing material specified above, installed in strict accordance with the manufacturer's printed instructions. If manhole sections are sealed with a flexible preformed bitumastic sealing material, adequate material shall be applied so that "squeeze out" occurs at the interior and exterior of the joint. Rubber joint ring gaskets and flexible preformed bitumastic sealing material shall be provided by the manhole manufacturer.

10. Sealing Compound and Grout: Plastic sealing compound shall comply with Federal Specification SS-S-00210. Mortar shall comply with ASTM C-387, Type S, or use grout complying with Section 3600.
11. Eccentric precast concrete cone sections shall be manufactured of precast concrete with reinforcing and joints as specified above for straight riser sections.
12. Lifting holes through the structures are not permitted. Equally spaced lifting lugs, rings or non-penetrating lift inserts shall be provided.
13. Top slabs for shallow manholes and pumping station wetwells may be precast or cast-in-place. Steel reinforcing shall be as indicated on the Drawings. Concrete for top slabs shall have a compressive strength of 4,000 psi at 28-days. Thickness of concrete for top slabs for manholes, wetwells and valve vaults shall be as shown on the Drawings.
14. Manholes inverts shall be precast into the manhole base section by the manhole manufacturer unless prior approval is obtained from the Engineer to construct inverts in the field. The drop from inlet to outlet shall be a minimum of one inch unless approved by the Engineer. The channel height of the manhole invert shall match the crown of the exit sewer. Manhole benches shall be sloped a minimum of one inch per foot from the outside periphery of the manhole to the edge of the invert channel.

B. Pipe Connections:

1. Pipe connections for wetwells and manholes shall be resilient, waterproof connections designed in accordance with ASTM C 923 "Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes." Resilient pipe connectors shall either be cast into the manhole wall or installed following casting in a cored section of the manhole wall. Resilient connectors shall either be a gasket type connector equal to the A-Lok pipe to manhole seal as manufactured by Atlantic Concrete Products, Inc., or a flexible neoprene boot with stainless steel clamps equal to the KOR-N-SEAL System as manufactured by the Dukor Corporation. When the pipe is installed in the resilient manhole connector, the pipe shall be capable of 200 minimum deflection in any direction.

2. Pipe connections for wall penetrations for valve vaults shall be provided with wall sleeves and link seals or as specified in Section 15050.
- C. Frames and Covers: Cast iron manhole frames and covers shall be provided for manholes and aluminum access hatches shall be provided for wetwells and valve vaults as specified below:
1. Standard Manhole Frames and Covers: Shall be gray iron castings conforming to ASTM A 48, Class 30B for Gray Iron Castings; and shall be smooth, true to pattern, free from blow holes, sand holes, projections and other harmful defects. The seating surfaces of both the frame and cover shall be machined so that the cover will not rock after it has been seated. The cover shall be provided with a precisely machined dovetail groove with a neoprene O-ring gasket to provide a self-sealing cover. The gasket shall be glued in place at the foundry. The manhole cover shall be solid with two non-penetrating pick holes. Manholes, frames and covers shall be coated on all non-machined surfaces with three coats of coal tar epoxy as specified in Section 09900. Manhole frames and covers shall be U.S. Foundry and Manufacturing Corp. No. 170-E. Covers shall be embossed with Owner information as shown on the Drawings, or an equal approved by the Engineer.
 - a. Anchor Bolts: Anchor bolts for bolting manhole frame to precast manholes shall be 3/4-inch diameter galvanized all thread steel rods with a 5 inch hook for embedment in the precast manhole top. The bolts shall be of sufficient length to provide a minimum 2-inch thread projection through the flange of the manhole frame. Two anchor bolts shall be cast into the precast manhole top section or slab, positioned at 180 degrees, at the time of manufacture. Manhole frames shall be drilled to match the bolt settings prior to coating.
 2. Aluminum Access Hatches: Aluminum hatches shall be provided for wetwells and valve vaults sized as indicated on the Drawings. Access hatches shall be as specified in Section 08350.
- D. Coatings:
1. Exterior surfaces of precast structures shall be coated with a primer coat and three finish coats of coal tar epoxy as specified in Section 09900.
 2. Interior surfaces of precast structures shall be coated with a primer coat and three finish coats of coal tar epoxy alternating color as specified in Section 09900.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Earthwork: The Contractor shall prepare an excavation large enough to accommodate the structure and permit sealing of openings, waterproofing, and backfilling operations. Earthwork shall conform to the applicable sections of Division 2.
- B. Installation of Precast Concrete Structures: Precast concrete structures shall be constructed in a workmanlike manner at the locations and dimensions indicated on the Drawings. Precast structures shall be set on a foundation of crushed stone, 12 inches thick. Crushed stone material shall be a well-graded crushed stone or crushed gravel meeting the requirements of ASTM C33, Gradation No. 67 (3/4 inch to No. 4 sieve). The precast structures shall be constructed such that the structure will not transmit dead or live loads to the piping. Care shall be taken to prevent earth and other material from entering precast structures.
- C. Sealing and Grouting: Fill all interior and exterior joints between precast sections with a joint sealant, as recommended by the structure manufacturer.
- D. Installing Precast Sections:
 - 1. Set each precast concrete unit plumb on a bed of sealant to make a watertight joint at least 1/2-inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the excess sealant.
 - 2. Assemble units so that the cover conforms to the elevations shown on the Drawings.
 - 3. Pipe connections at precast structures shall be provided at the locations shown on the Drawings. Connections shall be resilient and waterproof
 - 4. All voids in interior and exterior manhole section joints and lift holes for manhole sections shall be filled with a non-shrinking, non-metallic grout. Grout shall be applied and cured in strict accordance with the manufacturer's recommendations. The grout shall be finished smooth and flush with the wall surface of the manhole.
- E. Manhole Flow Channels and Bench Walls:
 - 1. Unless prior approval is obtained from the Engineer, manhole flow channels (inverts) and bench walls shall be precast into the manhole base section as specified above in Paragraph 2.01.A.14.

2. Upon prior approval from the Engineer, manhole inverts may be constructed in the field. Invert channel bottoms shall be smooth and semicircular in shape conforming to inside of adjacent sewer sections. Changes in direction of flow shall be made with a smooth curve of as large radius as the size of manhole will permit. Changes in size and grade of channels shall be made gradually and evenly to give a smooth uninterrupted flow pattern through the manhole. Channel height shall match the crown of the connection sewer pipe exiting the manhole. Manhole bench walls shall be smooth and shall slope one inch per foot from the edge of the invert channel to the precast manhole wall. Invert channels may be constructed by forming in concrete or by building up brick and mortar to form the manhole bench walls on each side of the channel, and plastering over bricks with cement mortar with a minimum thickness of 1/2-inch. Manhole invert construction shall only be performed by experienced and qualified workmen.
3. Bricks used to construct manhole invert channels and bench walls shall be standard size (2 1/2-in. H X 4 in. W X 8-in. L) brick in conformance with ASTM C 32 "Sewer and Manhole Brick (Made From Clay and Shale)," mixing: One (1) volume of Type II Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of approved consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well-graded, and shall pass a standard No. 4 sieve.

F. Setting Frames and Covers:

1. Unless otherwise indicated on the Drawings, in unpaved areas the tops of manholes shall be set 0.2-feet above finished grade and the tops of wetwells and valve vaults shall be set 0.5-feet above finished grade, unless otherwise indicated on the Drawings.
2. The top of all precast manholes may be brought to proper grade for receiving manhole frame by using not more than three courses of brick or precast concrete grade rings. Bricks and mortar used for manhole top grade adjustment shall be as specified above in Paragraph 3.01.E.3. Precast concrete grade rings shall be precast with steel reinforcement in conformance with ASTM C 478 and concrete with a compressive strength of 4000 psi in 28 days. Precast concrete grade rings shall be manufactured in half annular shapes for easy of handling. The grade ring dimensions shall be 2-inches thick with an annular width of 8-inches and an inside diameter of 24-inches.
3. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick shall be laid in full beds of mortar and shoved into place. All

joints shall be full and not more than 1/2-inch in thickness. The Contractor shall set in place and bond in the masonry all necessary anchor bolts and miscellaneous items specified elsewhere. The masonry walls shall be plastered on the inside and outside with a one-half inch coat of Portland Cement mortar.

4. Following curing of any masonry construction required for manhole top adjustment, set manhole frame in a bed of 1/4- to 1/2-inch thick flexible bitumastic sealing material (Ram-Nek) and anchor in place with two 3/4-inch diameter anchor bolts, which shall be securely embedded in the top of the manhole. Seal the flange of the manhole ring to the top of the manhole with cement mortar.
- G. Interior Coating: The interior coating system shall be applied following installation of the precast structures and any piping or equipment which will penetrate or attach to the walls. Surface preparation and application of the coating system shall be in strict accordance with the manufacturer's recommendations. Refer to Section 09900 for additional specifications.
- H. Backfill: After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the Drawings. Backfill material shall consist of sand or loose earth, free from stones, clods, or other deleterious material. It shall be placed in horizontal layers not exceeding 12-inches in depth, and shall be moistened and thoroughly compacted to a minimum relative density conforming to the requirements of Division 2.

END OF SECTION

SECTION 03415

PRECAST PRESTRESSED CONCRETE MEMBERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Design, cast, deliver, erect and store precast prestressed concrete structures and joists and other members as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

- A. Provide the product of a manufacturer of precast prestressed units having at least 5-years experience in the manufacture and erection of similar units under the same corporate name and ownership and provide to the Engineer written evidence of such manufacturer's experience and adequacy of manufacturer's plant and facilities to perform the work. The manufacturer shall have on its staff a full-time Professional Engineer, who shall have no less than 5-years experience in the design and field construction of precast prestressed concrete structures and joists, who shall be the responsible engineer in charge of the work to be done.
- B. Plant Inspection: Notify the Engineer 5-days before the units are cast, and 5-days before shipment is made, in order to provide for plant inspection, if the Engineer so directs.
- C. Test: Make at least three (3) test cylinders of each day's concrete production, and perform compression test thereon at 28 days. Maintain records of all such tests.

1.03 REFERENCES

- A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the following standards:
 - 1. Standard Building Code.
 - 2. ACI 318, Building Code Requirements for Reinforced Concrete.
 - 3. PCI Design Handbook, latest edition.
 - 4. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.

5. ASTM A416, Uncoated Seven-Wire Stress-Relieved Strand for Prestressed Concrete.
6. AWS D1.1, Structural Welding Code.
7. AWS D12.1, Reinforcing Steel Welding Code.

1.04 SUBMITTALS

- A. Submit the following information to the Engineer for approval, in accordance with Section 01340. Do not start fabrication until submission has been approved.
 1. Quality Control: Satisfactory evidence shall be submitted that plant and production methods meet the requirements of PCI MNL 116, including the following:
 - a. Batch plant scale certifications
 - b. Stressing jack certifications
 - c. Testing machine certifications
 - d. Daily aggregate moisture tests
 - e. Concrete batch tickets
 - f. Cement mill certifications
 - g. Course aggregate mill certifications
 - h. Fine aggregate mill certifications
 - i. Prestressing strand mill certifications
 - j. Quality control manual
 - k. Quality control inspection reports
 - l. Concrete compression test results
 2. Design: Completed calculations, including shear, moments and camber shall be submitted, all bearing the signature and seal of a Professional Engineer registered in the State of Florida.

3. Shop Drawings: Complete fabrication and erection drawings, all bearing the signature and seal of a Professional Engineer registered in the State of Florida.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Provide qualified personnel, using proper equipment, for transportation and erection of the units. Lift and support the units only at points indicated on the shop drawings.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Use materials and fabrication methods meeting all requirements of the specified standards, with tolerances in accordance with the recommendations of PCI MNL 116.
- B. Construct the prestressed units to the size and configuration shown on the Drawings. Design the units in accordance with ACI 318 to safely support the designated superimposed loads and to meet all special requirements shown on the Drawings. Do not exceed the permissible stresses in Sections 18.4.1 and 18.4.2 of ACI. Minimum 28 days compressive strength of the concrete shall be 6,000 psi and minimum release strength shall be 3,500 psi. Allowable tensile stress in the bottom of concrete joists shall be 0.0 (zero) PSI under full superimposed load and live loadings.
- C. Provide a standard finish such as is produced in plastic-lined or metal forms. Units with honeycomb, structural defects, "ghosting" of mesh or other reinforcing, or other imperfections will, at the discretion of the Engineer, be rejected.
- D. Provide walls or joists of standard weight concrete having a minimum average cover of 2 1/2-inches over the prestressing strands and spiral ties, with the composite system of joist and concrete slab providing a 1-hour fire rating acceptable to the Building Official.
- E. Openings: Cast openings in tanks as indicated on the Drawings. Do not cut openings in field unless approved in writing and sealed by the Engineer responsible for the design of the prestressed members.

PART 3 - EXECUTION

3.01 ERECTION

- A. Place, align, and level the precast units in final position maintaining the tolerances recommended in PCI MNL 116, including all forming and shoring necessary to complete the field installation. Design shoring to safely support construction loads without exceeding design loads of completed portions of the building supporting the shoring. Remove all shoring and formwork upon completion. Correct variations in camber between adjacent tees by loading.
- B. Camber: Camber of the finished composite slab system without superimposed loads shall not exceed 1/2-inch rise nor shall there be any deflection between lines of support.

END OF SECTION

SECTION 03600

GROUT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included in this Section consists of grouting the various items listed hereinafter and indicated on the Drawings:
- B. Related Work Described Elsewhere:
 - 1. Cast-In-Place Concrete: Section 03300.

1.02 SUBMITTALS

- A. Materials and Shop Drawings: Manufacturer's literature shall be submitted for review on nonshrink grout data, shall include grout properties, mixing, surface preparation and installation instructions, and shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples .

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Grouting materials shall be delivered and stored in unbroken containers with seals and labels intact as packaged by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Nonshrink, Nonmetallic Grout: Sauereisen F-100 Level Fill, Master Builders Masterflow 713, Burke Non-Ferrous, Non-Shrink Grout or equal pre-mixed type.
- B. Nonshrink Metallic Grout: Master Builders Embeco 636 Grout pre-mixed type.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All bonding surfaces shall be clean; dust and oil free.

3.02 INSTALLATION

A. Nonshrink Grout:

1. Nonshrink, nonmetallic grout shall be used for grouting column base plates, anchor bolts, reinforcing bars, pipe sleeves, machinery supports and pump base plates.
2. Nonshrink grout shall be mixed and placed as recommended by the manufacturer.
3. Grout shall be mixed as close to the work area as possible and transported quickly to its final position in a manner that will not permit segregation of materials.
4. Nonshrink grout shall be cured with water saturated burlap for at least 3 days.
5. Machinery set on grout pads shall not be operated until the grout has cured for at least 36-hours.

END OF SECTION

SECTION 03800

LEAKAGE TESTING OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Test concrete hydraulic structures for leakage as described herein.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Water: Potable.
- B. Piping: As required to fill and empty structures.
- C. Equipment: As required to fill and empty structures.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Hydrostatically test concrete structures which are intended to contain liquid to determine that they are watertight and free of detectable leaks.

3.02 INSPECTION AND TESTING

- A. Prior to testing, clean exposed surfaces by thorough hosing and remove all loosened matter and wash water from the structures.
- B. Conduct testing before backfill is placed against walls and after all concrete has attained the specified compressive strength.
- C. Fill hydraulic structures to be subjected to leakage tests with water to the normal liquid level line. Do not fill more than 36-inches of water depth per day, unless otherwise approved by the Engineer. Repair any running leaks, which appear during filling, before continuing. After the structure has been kept full for 48-hours, it will be assumed, for the purposes of the tests, that the absorption of moisture by the concrete in the structure is complete. Then, close all valves and gates to the structure and measure the change in water surface each day for a five-day period.

- D. During the test period, examine all exposed portions of the structure, and mark all visible leaks or damp spots. Repair such leaks or damp spots later. If the drop in water surface in a 24-hour period exceeds 1/10 of 1 percent of the normal volume of liquid contained in the structure, the leakage will be considered excessive.
- E. If the leakage is excessive, drain the structure, repair leaks and damp spots, refill the structure and again test for leakage. Continue this process until the drop in water surface in a 24-hour period, with the structure full, is less than 1/10 of 1 percent of the volume.
- F. Evaporation and precipitation rates shall be independently measured as part of the leakage test.
- G. Make repairs and additional tests at no additional cost to the Owner.
- H. Apply specified coatings only after acceptance of leakage testing by the Engineer.

3.03 REPAIR METHODS

- A. Repair concrete not passing the leakage test in conformance with the applicable provisions of Division 3 and to the satisfaction of the Engineer.

END OF SECTION

SECTION 04200
UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Concrete building brick.
3. Building (common) brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry-cell insulation.
11. Cavity-wall insulation.

B. Related Sections:

1. Division 03 Section "Cast-in-Place Concrete" for installing dovetail slots for masonry anchors.
2. Division 08 Section "Louvers and Vents" for wall vents (brick vents).

1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement"
 - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties
 - 2. Cementitious materials. Include brand, type, and name of manufacturer.
 - 3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 - 4. Grout mixes. Include description of type and proportions of ingredients.
 - 5. Reinforcing bars.
 - 6. Joint reinforcement.
 - 7. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.
- C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 2. Protect sills, ledges, and projections from mortar droppings.
 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide bull nose units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi
 2. Density Classification: Normal weight
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

2.3 CONCRETE LINTELS

- A. General: Provide one of the following:

- B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete," and with reinforcing bars indicated.
- C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C 91.
- E. Mortar Cement: ASTM C 1329.
- F. Aggregate for Mortar: ASTM C 144.
- G. Aggregate for Grout: ASTM C 404.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
 - 1. Exterior Walls: Hot-dip galvanized carbon steel, or stainless steel.
 - 2. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 - 3. Provide in lengths of not less than 10 feet
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 641/A 641M, Class 1 coating.
 - 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
 - 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304 First subparagraph below is allowed only for anchors and ties in interior walls where humidity is less than 75 percent.
 - 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 5. Stainless-Steel Bars: ASTM A 276 or ASTM a 666, Type 304.
- B. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

2.7 MISCELLANEOUS ANCHORS

- A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.
- B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.
- C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- D. Postinstalled Anchors:
 - 1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
 - 3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
 - 1. Fabricate through-wall flashing with sealant stop. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
 - 2. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 3. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- B. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge. Where flashing is fully concealed, use metal flashing.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

2.10 MASONRY-CELL INSULATION

- A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.11 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.12 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Specification. Provide the following types of mortar for applications stated.
 - 1. For reinforced and non-reinforced masonry, use Type S
 - 2. For interior non-load-bearing partitions, Type N may be used instead of Type S.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, with compressive strength of not less than 2500 psi.

PART 3 - EXECUTION

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
6. to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.3 LAYING MASONRY WALLS

- #### A.
- Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

3.5 MASONRY-CELL INSULATION

- A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story high, but not more than 20 feet.

- B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
- B. Provide continuity at wall intersections by using prefabricated T-shaped units.
- C. Provide continuity at corners by using prefabricated L-shaped units.
- D. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

3.8 LINTELS

- A. Provide concrete or masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- B. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and

with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

3.12 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 3. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

3.13 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 04750

SUBMERSIBLE SANITARY SEWER PUMP STATION

1.01 SCOPE:

A. The work under this section of the specifications shall consist of furnishing and installing a sewage pumping station complete including pumping units, piping, valves, access hatches, and other miscellaneous items, to the limits shown on the drawings.

B. Site work shall be as specified in Excavation and Backfill Section of these specifications.

C. Reinforced Concrete Work shall be as specified in Concrete Work Section of these specifications.

1.02 GENERAL:

A. All materials and equipment shall be new and unused when delivered to the site and shall be subject to inspection by the Engineer before installation.

B. It is the intent of these Specifications that, to assure overall system quality and operational unity, the pumps, motors, starters, controls, and other auxiliary equipment and materials as shall be furnished and/or coordinated by the pump manufacturer who shall assume responsibility for the satisfactory operation of the pumping system including pumps, motors, controls, starters and accessories.

1.03 APPROVAL OF MATERIAL AND EQUIPMENT:

A. Within 30 days after notice to proceed is issued, the Contractor shall submit, for the approval of the Engineer, shop drawings and/or manufacturer's description sheets for the following materials and/or equipment:

1. Piping and Fittings	5. Guide Rails
2. Submersible Pumps	6. Discharge Elbow
3. Access Hatch	
4. Valves	

B. Submittals shall include six (6) copies for each item. Drawings and

manufacturer's descriptive materials shall include sufficient detail to clearly establish that the item submitted meets the specifications.

C. Items installed without approval of the Engineer shall be subject to removal and replacement at no additional cost to the Owner.

1.04 SUBMERSIBLE PUMPS:

A. Furnish and install two submersible non-clog wastewater pumps in the sewage pumping stations as detailed on the drawings.

B. The pumps shall be totally submersible, electrically operated, and capable of pumping raw, unscreened sewage. Each unit shall meet the following characteristics:

	US 441 LS
Design Capacity (GPM)	300 gpm
Design TDH (Feet)	57 ft
Motor Horsepower	7.5 hp
Electrical Service	230 V - 3 Ph
Discharge Size (Inches)	4"

C. The pumps shall be capable of handling raw, unscreened wastewater. The pumps shall be capable of passing a minimum 3" sphere. The discharge elbow shall be permanently installed in the wet well along with the discharge piping.

The pumps shall be automatically and firmly connected to the discharge connection elbow when lowered into place.

The pumps shall be easily removable for inspection or service, having no bolts, nuts, or other fasteners to be disconnected. There shall be no need for personnel to enter the pump well.

Sealing of the pumping unit to the discharge to the discharge connection elbow shall be accomplished by a mechanical metal to metal watertight contact. A sliding guide bracket shall be an integral part of the pump unit.

The entire weight of the pumping unit shall be guided by no less than two guide bars; each made of 304 stainless steel; and pressed tightly against the discharge connection elbow with metal-to-metal contact. Sealing of the

discharge interface by means of a diaphragm, O-Ring, or profile gasket will not be acceptable. No portion of the pump shall bear directly on the floor of the sump.

The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet. Lowering and raising of the pump shall be accomplished using a galvanized steel chain. The chain size shall be as per the manufacturers' recommendation.

D. All major parts such as the stator casing, oil casing, sliding bracket, volute and impeller shall be of gray iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes and other irregularities.

Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of AISI type 304 stainless steel. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, shall be protected by a factory applied spray coating of alkyd primer with a polyester paint finish on the exterior of the pump.

E. A wearing ring system shall be capable of efficient sealing between the volute and suction inlet of the impeller. Each pump shall be equipped with a brass, or nitrile rubber coated steel ring that is drive fitted to the volute inlet.

F. The impeller shall be of gray cast iron, Class 35B, and shall be of the non-clogging design, with a long throughlet without acute turns. The impeller shall be dynamically balanced, double shrouded, and shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal wastewater applications. Whenever possible, a full vaned, not vortex, impeller shall be used for maximum hydraulic efficiency.

The pump manufacturer shall, upon request, furnish mass moment of inertia data for the proposed impeller. The impeller shall be capable of passing a minimum three (3) inch solid sphere. The impeller shall be keyed to the shaft, retained with an Allen head bolt. Non-corroding fasteners shall be used. All impellers shall be coated with an acrylic dispersion zinc phosphate primer.

G. Each pump shall be provided with a tandem mechanical rotating shaft seal system, consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydrodynamically lubricates the lapped seal faces at a constant rate.

The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring.

The upper, secondary seal unit, located between the lubricant chamber and

the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide seal ring.

Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment nor depend on direction of rotation for sealing. The position of both mechanical seals shall depend on the shaft.

Mounting of the lower mechanical seal on the impeller hub will not be acceptable. Each pump shall be provided with a lubricant chamber for the shaft sealing system.

The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity.

The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate dry without damage while pumping under load. Seal lubricant shall be FDA approved, nontoxic.

H. All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber O-rings. Fittings shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces.

This will result in controlled compression of nitrile rubber O-rings without the requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

I. The pump motor shall be a squirrel-cage, induction, shell type design, housed in an air-filled, watertight chamber, NEMA B type. The stator winding and stator leads shall be insulated with moisture resistant Class F insulation which will resist a temperature of 155°C.

The stator shall be dipped and baked three times in Class F varnish and shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing shall be rejected.

The motor shall be designed for continuous duty handling pumped media of 40°C and capable of sustaining a minimum of 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be of aluminum. Thermal switches set to open at 125°C shall be embedded in the stator lead coils to monitor the temperature of each phase winding.

These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel. The junction chamber containing the terminal board shall be hermetically sealed

from the motor by an elastomer compression seal. Connection between the cable conductors and stator leads shall be made with threaded compression type binding posts permanently affixed to a terminal board. Wire nuts or crimping type connection devices are not acceptable. The motor and pump shall be designed and assembled by the same manufacturer. The motors shall have a 1.15 service factor.

J. The cable entry water seal design shall preclude specific torque requirements to insure a water tight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by stainless steel washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable.

The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

K. Motors shall be sufficiently cooled by the surrounding environment or pumped media. A water jacket shall not be required.

L. All stators shall incorporate thermal switches in series to monitor the temperature of each phase winding. At 125⁰C the thermal switches shall open, stop the motor and activate an alarm.

M. The pump manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and material for a period of five (5) years or 10,000 hours under the Municipal Warranty Policy under normal use, operation and service. The warranty shall be in printed form and apply to all similar units.

1.05 INSPECTION AND TESTING:

A. The pump manufacturer shall perform the following inspections and tests on each pump before shipment from the factory:

1. Impeller, motor rating and electrical connections shall be first checked for compliance with these specifications.
2. A motor and cable insulation test for moisture content or insulation defects shall be made.

3. Prior to submergence, the pump shall be run dry to establish correct rotation and mechanical integrity.
4. The pump shall be run for a minimum of 30 minutes submerged, a minimum of six (6) feet under water.
5. After operational test number 4, the insulation test number 2 is to be performed again.
6. Laboratory performance test in accordance with the Hydraulic Institute Standard. Test shall include shutoff head, and flow, total head, power input and efficiency, and motor amperage at a minimum of four (4) points along the pump curve.
7. A written report certifying the above tests have been done and showing the results thereof shall be supplied with each pump at the time of shipment.

B. The manufacturer shall furnish the services of a factory representative who shall have complete knowledge of proper operation and maintenance to inspect the final installation and supervise the initial start-up of the equipment. The manufacturer's representative shall be available for a minimum of four (4) hours for each pumping station.

C. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

D. If the equipment does not meet the final test, the Contractor shall, at his own expense, make such arrangements and adjustments in the equipment which is deemed necessary and shall conduct further tests until full satisfaction is indicated by the Owner and Engineer. The final test shall demonstrate that all items of these Specifications have been met as installed. These items shall include, but not be limited to, the following tests:

1. that all units have been properly installed and are in correct alignment;
2. that the pumps can be easily raised and lowered on the guide rail system throughout the full length, and that connections to the discharge elbow function properly;
3. that the units operate without overheating or overloading any parts and without objectionable vibration;

4. that there are no apparent mechanical defects in any of the parts;
and
5. that the pump sensors and controls perform satisfactorily with correct start, ramping, and stop elevations and proper level alarm functions.

Upon completion of the Final Acceptance Test, all motors shall be checked for correct clearance and alignment and for correct lubrication in accordance with Manufacturer's recommendations. If the pump performance fails to meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the conditions specified.

1.06 PIPING:

- A. All piping to the limits as indicated on the drawings shall be ductile iron.
- B. Ductile iron pipe shall be in accordance with AWWA C151, Class 50, flanged type joint.
- C. Fittings shall be in accordance with AWWA C110, flanged or mechanical joints, as indicated on the drawings.

1.07 VALVES & FITTINGS:

- A. Gate valves shall be in accordance with the water distribution section and shall have mechanical joint or flanged ends as shown on the drawings.
- B. Check valves shall be in accordance with of the water distribution section and shall have flanged ends as shown on the drawings.
- C. Fittings shall be in accordance with the water distribution section and shall have mechanical joint or flanged ends as shown on the drawings.

1.08 ACCESS HATCH:

- A. The access hatches for the pump station wet well and valve pits shall be provided by the pump manufacturer and shall be of the size as shown on the drawings. Each shall have a 1/4" thick, one-piece, mill finish, extruded aluminum frame, incorporating a continuous concrete anchor, and designed to withstand H-20 loading.
- B. Door panels shall be 1/4" aluminum diamond plate, reinforced to withstand

H-20 loading. Doors shall open to 90° and automatically lock with a stainless steel hold arm with aluminum release handle. Door shall close flush with frame.

C. Lifting handles, hinges, and all fastening hardware shall be stainless steel. Unit shall lock with non-corrosive locking bar.

D. Hatches shall be by Halliday Products, The Bilco Company, or approved equal.

1.09 PAYMENT:

No separate payment will be made for work under this section of the specifications, except as set forth in the Bid Schedule. The cost of such work and all costs incidental thereto shall be included in the price bid for the item to which the work pertains.

SECTION 05120

STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and incidentals necessary to install structural steel including bearing plates, columns, beams, and miscellaneous shapes and plates required to erect the structural framing as shown on the Drawings and specified herein.
- B. Furnish anchor bolts with templates to be installed under Division 3. Furnish and install nuts and washers for anchor bolts.
- C. Install portions of masonry ties to be welded to structural steel as shown on the Drawings and as specified herein.

1.02 Related Work Described Elsewhere:

- A. Cast-In-Place Concrete: Section 03300.
- B. Metal Fabrications: Section 05500.
- C. Painting: Section 09900.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01340: shop drawings, working drawings and samples, detailed erection drawings, schedules, and data for all structural steel. Drawings shall bear the seal of Professional Engineer registered in the State of Florida. Approval will be for strength only and shall not relieve the Contractor of responsibility for proper fit of members, of connections not detailed on the Drawings, or for supplying all material required by the Contract Documents. Mark numbers painted on the shop-assembled pieces of steel shall be the same mark numbers used on the detailed shop and erection drawings.
- B. Certified mill test reports for the structural steel and the bolting materials.
- C. Certifications that welders are qualified, in accordance with AWS D1.1, on the shop and field welding procedures to be used.

1.04 REFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)

1. Code of Standard Practice for Steel Buildings and Bridges.
2. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Structural Steel.
2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless
3. ASTM A123 - Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
4. ASTM A307 - Standard Specification for Carbon Steel Externally Threaded Standard Fastener.
5. ASTM A325 - Standard Specification for High Strength Bolts for Structural Steel Joints.
6. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
7. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

C. American Welding Societies (AWS)

1. AWS A5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
2. AWS D1.1 - Structural Welding Code Steel.

D. Local Codes

1. Standard Building Code.

E. Steel Structures Painting Council (SSPC)

1. Steel Structures Painting Council (SSPC), Surface Preparation Specifications.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver anchor bolts and other anchorage devices, which are to be embedded in the work of other trades, to the project site in sufficient time to permit their timely installation. Provide proper setting drawings, templates and directions for installation of these items.
- B. Store structural steel members above ground on platforms, skids or other supports. Store all fasteners and welding electrodes in a weather-tight and dry place until ready for use. Store packaged materials in their original containers.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Shapes, Plates and Bars: ASTM A-36.
- B. Structural Tubing: ASTM A-500, Grade B ($F_y = 46$ ksi).
- C. Bolts:
 1. Anchor Bolts: Type 316 Stainless Steel.
 2. Structural Steel: ASTM A-325.
- D. Welding Electrodes: As permitted by AWS Code.
- E. Shop Paint Primer: See Section 09900.

2.02 FABRICATION

- A. Fabrication shall meet all requirements of the specified standards.
- B. Fabricate and assemble structural steel in the shop to the greatest extent possible. Do all shearing and flame cutting carefully and accurately using machine equipment where possible.
- C. Match-mark materials for field assembly. Ream unmatched holes in shop assembly of field connections. Reject and replace with new pieces any piece weakened by reaming to a point where the strength of the joint is impaired.

- D. Weld connections or bolt as indicated. Weld shop connections not otherwise shown. Eccentric connections are not permitted unless shown in detail on the structural Drawings. Bolted connections shall have a minimum of two bolts.

2.03 SURFACE PREPARATION AND SHOP COATINGS

- A. Prepare and shop prime paint non-galvanized members as specified in Section 09900. Do not prime paint faying surfaces of slip critical connections.
- B. Galvanize members and their attachments exposed in whole or part to the weather, including beams supporting exterior masonry. Galvanize other members as indicated on the Drawings. Galvanizing shall be done after fabrication and in accordance with ASTM A123. Thoroughly clean, pickle, flux, and immerse members in bath of molten zinc until their temperature becomes the same as the bath. Coating shall be 2-oz. per sq. ft.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Before starting work, verify locations and elevations of bearings and anchor bolts. Immediately report inaccuracies. Work under this Section includes responsibility for accurate bearing of steel and correct location of anchorage.

3.02 ERECTION

- A. Erection shall be in accordance with the requirements of the specified standards.
- B. Weld field connections or bolt as indicated.
- C. Bolting:
 - 1. As erection progresses, bolt up work to take care of all dead loads, construction live loads, lateral forces and erection stresses.
 - 2. Unless otherwise noted, erection bolts used in welded construction may be either tightened securely and left in place, or removed and the holes filled with plug welds.
 - 3. Drift pins may be used for assembling parts provided metal is not distorted or holes enlarged. Ream holes requiring enlargement to admit bolts. Misaligned holes will subject members to rejection.
 - 4. Make all steel to steel connections by high strength bolting except where field welding is specifically shown. Provide not less than two ¾-inch bolts per connection and use not less than ¼-inch thick clip angles.

5. Tighten bolted connections designated as bearing-type connections to the snug tight condition. Where specified, tighten other bolted connections to full pretension by turn-of-nut or calibrated wrench tightening.

D. Welding:

1. Field welding shall be done only where shown or specified and only be welders qualified for the procedures used. No welding shall be done when surfaces are wet, exposed to rain or wind, or when welders are exposed to inclement conditions that will hamper good workmanship.
2. Each welder shall be assigned an identification mark. This mark shall be made at each completed connection with a paint stick.

E. Temporary Bracing: Introduce wherever necessary to provide for all loads to which structure is subjected including erection equipment and its operation. Leave in place until no longer required for safety. Make proper provisions for construction loads, piles of materials, equipment, etc., carried by structural frame during erection.

F. Touch-up Painting: After erection, clean all fixed connections (bolts and welds) as specified in Section 09900 and spot paint all abrasions with same primer as used in shop. Finish painting shall be as specified in Section 09900.

G. Zinc coating which has been burned by field welding, abraded, or otherwise damaged shall be cleaned and repaired after erection of structural steel. 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.

3.03 INSPECTION

- A. The Engineer shall have free access to the work. The Contractor shall notify the Engineer in writing four (4) days in advance of any welding or high strength bolting operations.
- B. High-strength bolting may be visually inspected. All high-strength bolts shall have the turned portion marked with reference to the steel being connected after the nut has been made snug and prior to final tightening. These marks shall be considered in the inspection. Rejected bolts shall be either replaced or retightened as required. In cases of disputed bolt installations, the bolts in question shall be checked by a calibrated wrench certified by an independent testing laboratory selected by the Owner.

- C. Field welding will be inspected visually by AWS certified welding inspectors provided by the Owner. Magnetic particle testing or ultrasonic testing may be used in the inspection if deemed necessary by the welding inspector. Comply with all requests of inspector to correct deficiencies.
- D. All costs for testing and inspection required as a result of defection work, repairs, or retests shall be paid for by the Contractor.
- E. Any material or workmanship, which is rejected by the Engineer either at the shop, mill, or building must be promptly replaced by the Contractor to the Engineer's entire satisfaction.
- F. The fact that steel work has been accepted at the shop and mill shall not prevent its final rejection at the site, or even after it has been erected, if it is found to be defective in any way.
- G. Any steelwork rejected at the site shall be removed by the Contractor from the premises within ten (10) working days from the time the Contractor is notified of the rejection.

3.04 FIELD QUALITY CONTROL

- A. Erection Tolerances: Erect individual pieces so that the deviation from plumb, level and alignment shall not exceed 1:500.

END OF SECTION

SECTION 05140

STRUCTURAL ALUMINUM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work under this Section includes fabrication and erection of structural aluminum, as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Metal Fabrications: Section 05500.
 - 2. Handrails and Railings: Section 05520.

1.02 QUALITY ASSURANCE

- A. Standards: Unless otherwise specified, all materials, workmanship and practices shall conform to the following Standards:
 - 1. Standard Building Code.
 - 2. Aluminum Construction Manual, Latest Edition, by the Aluminum Association.
- B. Qualifications: Fabrication and erection shall be by a qualified fabricator and erector approved by the Engineer. Preparation of shop drawings shall not begin until the fabricator and erector have been approved.

1.03 SUBMITTALS

- A. Materials and Shop Drawings: Complete shop drawings, including material lists, fabrication and erection drawings shall be submitted for review in conformance with Section 01340: Shop Drawings, Working Drawings and Samples. Fabrication shall not be approved until the submission has been approved.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Standard Shapes, Bars & Plates:
 - 1. ASTM B-209 - Alloy 6063-T6.
 - 2. ASTM B-308 - Alloy 6063-T6.
- B. Standard Threaded Fasteners:
 - 1. Aluminum Bolts Alloy 2024-T4.
 - 2. Aluminum Nuts Alloy 6063-T6.
- C. Welding Electrodes: 4043 filler metal.
- D. Checkered Plate:
 - 1. All checkered plates shall be aluminum, mill finish, and designed for a live load of 100 pounds per square foot of the gross projected area, with the limits for deflections as specified in Federal Specification RR-G-6610.
 - 2. Checkered plates shall be standard pattern non-slip plates of minimum 3/8-inch thickness and sizes shown on the Drawings. Stiffener angles (aluminum) shall be provided as required to meet the superimposed live load requirements specified above. All checkered plate sections shall be cut to the dimensions shown on the Drawings. Flush type lifting handles shall be provided for each plate, unless otherwise noted on the Drawings.
 - 3. Plate shall be 6063-T6 alloy aluminum. Raised lugs shall be diamond shaped and have an angled and opposed pattern.

2.02 FABRICATION

- A. Fabrication shall be in accordance with the specified standards. Splices not indicated on the Drawings will not be permitted.
- B. Surface Treatment: Treatment is required only if indicated on the Drawings.

PART 3 - EXECUTION

3.01 ERECTION

- A. Erection shall be in accordance with the specified standards and as indicated on the Drawings.
- B. Welding: Welding on aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) process, per the AWS Welding handbook.

- C. Painting: No painting is required.
- D. Where the contact of dissimilar metals may cause electrolysis or where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used. Finished works shall be cleaned and excess cement removed.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section includes providing all labor, materials and equipment to install miscellaneous metals, shapes and sheets, and fasteners not specified elsewhere in these Specifications.
- B. Related Work Described Elsewhere:
 - 1. Cast-In-Place Concrete: Section 03300.
 - 2. Grout: Section 03600.
 - 3. Structural Steel: Section 05120.
 - 4. Structural Aluminum: Section 05140.
 - 5. Handrails and Railings: Section 05520.

1.02 QUALITY ASSURANCE

- A. Standards: All materials, practices and workmanship shall conform to the Standard Building Code.

1.03 SUBMITTALS

- A. Materials and Shop Drawings: The Contractor shall submit shop drawings which shall indicate fabrication, assembly and erection details, sizes of members, profiles, fastenings, supports and anchors, patterns, clearances and connection to other work for review in conformance with Section 01340: Shop Drawings, Working Drawings and Samples. Shop drawings shall be approved by the Engineer before fabrication begins.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Structural Steel: Miscellaneous steel plates, shapes, bars and connections shall conform to the requirement of ASTM designation A-36.
- B. Concrete Anchors: Unless otherwise indicated on the Drawings, use Type 316 stainless steel wedge anchors as manufactured by Phillips Drill Company or equal. Where steel anchors are indicated, use a one-piece design with expander ring consisting of steel zinc coated and chrome plated as manufactured by McCullough Industries, Inc., Kwik Bolt, or equal.
- C. Bolts and Fasteners: Bolts for securing equipment, above grade piping and aluminum structures shall be stainless steel.
- D. Stainless Steel: Except where otherwise specified use Type 316, ASTM A-167 stainless steel plate, members, and washers. Use ASTM A-193, Grade B8M bolts and ASTM A-194, Grade 8M nuts.
- E. Welding Electrodes: Welding electrodes for structural steel shall conform to AWS A5.5, E70XX. Use 4043 filler metal for aluminum and type 347 electrode for stainless steel.
- F. Galvanizing: Use hot-dipped zinc coating for plates, bolts, anchor bolts and threaded parts in accordance with ASTM A-153. Zinc coat structural steel and pipe in accordance with ASTM A-123.
- G. Structural Aluminum: Structural shapes and plates shall conform to ASTM B241, Alloy 6063-T6.
- H. Abrasive Stair Nosings: Abrasive stair nosings shall be provided for all concrete stairs. Nosings shall be 3 inches wide safety groove treads complete with anchors and shall be Type 46 aluminum as manufactured by Wooster Products, Inc. or equal. Nosings shall extend full width of stair.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fabrication and Erection:

1. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded. All bolt holes shall be 1/16-inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.
2. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.
3. Set embedded metalwork accurately in position when concrete is placed and supported rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with grout in conformance with Section 03600: Grout.

B. Welding

1. Welding on steel shall be performed by the Shielded Metal Arc Welding (SMAW) process. Welding procedures shall comply with AWS B3.0.
2. Welding on aluminum shall be performed by the Gas Metal Arc (MIG) or Gas Tungsten Arc (TIG) process, per the AWS Welding Handbook.
3. Provide a minimum of two (2) passes for metal of 3/16-inch thickness plus one (1) additional pass for each additional 1/8-inch inch metal thickness.
4. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, non-uniform bead pattern, and high crown. Form fillet welds of the indicated size. Accomplish repair, chipping, and grinding of welds in a manner that will not gouge, groove, or reduce the base metal thickness.

C. Anchor Bolts and Anchors

1. Preset bolts and anchors by the use of templates. Do not use concrete anchors set in holes drilled in the concrete after the concrete is placed in place of cast-in-place anchor bolts.
2. After anchor bolts have been embedded, protect their threads by applying grease and by having the nuts screwed on until the time of installation of the equipment or metalwork.

D. Control of Flame Cutting: Do not use flame cutting by the use of gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a flame-cutting torch only on minor members when the member is not under stress.

E. Repair of Galvanized Surfaces: Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair of galvanized surfaces shall be affected by use of DRYGALV as manufactured by the American Solder and Flux Company; Cold Galvanizing Repair Compound as manufactured by Rust-O-leum, applied in accordance with the manufacturer's instructions; or equal.

F. Painting and Protective Coating:

1. All ferrous metal, except stainless steel and galvanized surface, shall be properly cleaned and given one shop coat of primer compatible with coating system specified in Section 09900: Painting. Anchors that are built into masonry shall be coated with asphalt paint unless specified to be galvanized. Metal work to be encased in concrete shall be left unpainted unless specified or noted otherwise. Where hot-dip galvanized or zinc coated metal is specified or shown, it shall be shop primed unless specifically not required. Castings that are to be left unpainted shall be cleaned and coated with a coal-tar-pitch varnish.
2. Aluminum to be placed adjacent to masonry or dissimilar metals shall be protected with an isolating coating of bitumastic and/or felt.

G. Dissimilar Metal Contact:

1. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used. Finished works shall be cleaned and excess cement removed.

2. All work shall be adequately anchored in place at proper elevations, planes and locations.

END OF SECTION

SECTION 05510

METAL STAIRS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section is intended to include shop fabrication of aluminum stairs complete with anchors and brackets, shop primed ready for site applied finish, including integral handrails and balusters when applicable.
- B. Related Work Described Elsewhere:
 - 1. Structural Aluminum: Section 05140.
 - 2. Metal Fabrications: Section 05500.
 - 3. Painting: Section 09900.

1.02 QUALITY ASSURANCE

- A. Standards:
 - 1. ASTM B-221, Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.
 - 2. Aluminum Association, Designation System for Aluminum Finishes.
 - 3. AWS D1.1 - Structural Welding Code.
 - 4. Standard Building Code.

1.03 SUBMITTALS

- A. Materials and Shop Drawings:
 - 1. Submit the Shop Drawings in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.
 - 2. Indicate construction details, sizes of metal sections, thicknesses of metals, profiles, attachments, dimensions and field joints, method of support from structure, work to be built-in or provided by other Sections and finishes.

3. Samples: Two (2) pieces, each 8-inches square in area, of each type finished material.
4. Indicate welded connections, both shop and field, using standard AWS welding symbols. Indicate net weld lengths.
5. Certificates: Manufacturer's certification that materials meet specification requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Verify dimensions on site prior to shop fabrication.
- B. Fabricate stairs, landings, and component connections to support live loads of minimum 100-pounds per square foot (psf) with deflection of stairs and landings not exceeding 1/360 of span.
- C. Fabricate integral railings and component connections capable of resisting lateral forces as indicated by the Standard Building Code.
- D. Shop assemble sections in largest practical sizes, easily handled through building openings.
- E. Accurately form and fit components and connections. Grind exposed edges and welds smooth and flush.
- F. Accurately form components required for proper anchorage of stairs and landings to each other and to building structure.

2.02 MATERIALS

- A. Aluminum: ASTM B-221, Alloy 6063, Finish AA-C 22A31.
- B. Components:
 1. Stringers: Aluminum.
 2. Headers: Aluminum.
 3. Risers: Aluminum.
 4. Railings: Aluminum.
 5. Handrails: Aluminum.

- C. Primer shall be as specified in Section 09900: Painting.

2.03 FABRICATION OF OPEN GRATING STAIRS (AND LANDINGS)

- A. Fabricate stairs with open risers with treads of open gratings.
- B. Treads: Minimum ¼-inch thick by 1-1/2-inches deep by width of stair.
- C. Properly secure treads to stringers; bolt in place.
- D. Form stringers of channels. Weld fascial plates of minimum 14-gauge sheet stock across channel toes.
- E. Landings same as treads, minimum ¼-inch thick by 1-1/2-inch deep grating. Reinforce underside of landings with angle T's.

PART 3 - EXECUTION

3.01 ERECTION

- A. Erect stairs square, level, plumb and free from distortion or defects detrimental to appearance and performance.
- B. Provide necessary anchors, plates, angles, hangers, and struts as required for connecting stairs to the structure. Stair assembly to be securely fastened to structure such that no swaying or other distortion of the assembly will occur.
- C. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.
- D. Perform necessary cutting and altering for the installation of work of other Sections. Do not perform any other additional cutting without review of the Engineer.
- E. Field bolt and weld to match standard of shop bolting and welding. Hide bolts and screws whenever possible. Where not hidden, use flush countersunk fastenings, unless indicated otherwise. Make mechanically fastened joints flush hairline butted. Grind welds smooth and flush.

END OF SECTION

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. This Section includes providing all labor, materials and equipment necessary to fabricate and install aluminum railings and accessories. All handrail shall consist of three (3) horizontal rails.

1.02 QUALITY ASSURANCE

A. Standards:

1. Occupational Safety and Health Administration Standards, latest edition.
2. Standard Building Code (design standards may exceed OSHA Design Standards). Design loading shall comply with Standard Building Code, 1994, Section 1608.2.

1.03 SUBMITTALS

- ###### A. Materials and Shop Drawings:
- Shop drawings for aluminum railings and accessories shall be submitted for review in conformance with Section 01340: Shop Drawings, Working Drawings and Samples. Fabrication shall not begin until Engineer's review is complete.

1.04 DELIVERY AND STORAGE

- ###### A. Deliver packaged materials to the site in manufacturer's original, unopened containers.
- Arrange deliveries to provide sufficient quantities to permit continuity of erecting of any phase of work.
- ###### B. Store to prevent damage to materials or structure.
- Cover handrails in protective polyethylene wrap to avoid damage to the anodized finish.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. The aluminum railing shall be equal to either one (1) of the following specifications, or an approved equal:
 - 1. Aluminum railing equal to the system produced by CV pipe rail, Craneveyor Corporation, South El Monte, California. All rails, posts and formed elbows shall be extruded aluminum tube, alloy 6063-T6. Splice and reinforcing sleeves shall be drawn aluminum tubing alloy 6063-T832. Brackets, end caps, toe boards and other fittings shall be extruded aluminum alloy 6063-T5. Fasteners, where used, shall be per "C-V Pipe Rail" standard details and shall be a Type 300 stainless steel. All exposed aluminum shall be anodized with a clear architectural Class I satin finish. The anodic coating shall be a minimum thickness of 0.7 mil and a minimum coating weight of 32 milligrams per square inch, in accordance with the Aluminum Association Designation AA-M12-C22A41. Posts, gates, brackets and other fittings shall be anodized after fabrication. Post and rail diameter shall be as shown on the Drawings.
 - 2. Aluminum railing equal to the system produced by C/S Rigid Rail 111, Construction Specialties, Inc., Alumaguard, Denver Colorado, or equal. All rails and posts shall be a special anodizing quality 6063 extruded Schedule 40 aluminum pipe with special tolerances to accept machined components. All other aluminum parts shall be fabricated from 6063 or 6061 extruded aluminum. All fittings, except bases, shall be a one-piece extrusion machined to final shape. All components shall be attached to the rails and posts by use of stainless steel blind rivets and self-tapping screws. Mounting hardware shall be Type 300 stainless steel. All aluminum railing and components shall receive a 215R1 clear anodize finish, minimum 0.7 mil coating. Post and rail diameter shall be as shown on the Drawings.
- B. Chains at openings between sections of railing will not be allowed. Contractor to provide either a removable section of handrail at these areas or fabricate a hinged gate with locking hasp.
- C. Aluminum kickplates where not specifically called for on the Drawings shall be furnished and installed typically at the edges of all elevated walkways. Kickplates shall be ¼-inch angle or plate stock (depending on the specific walkway edge detail) meeting OSHA requirements and shall project 4-inches above walkway surface. Kickplates shall not infringe on minimum required walkway width and material must be same as that of the railing construction. Kickplates shall not interfere with the removal of grating panels.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Insofar as possible, fabricated material shall be fitted and shop assembled ready for erection. Welding and equipment shall conform to American Welding Society's Code for Welding in Building Construction, latest edition. All work shall be square, plumb and true, accurately fitted with tight joints and intersections. Exposed work shall be finished smooth with welds ground smooth. The completed work shall conform to both OSHA Standards and the Standard Building Code. (Standard Building Code requires three horizontal rails).

3.02 ERECTION

- A. Installation: Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be separated using not less than one (1) coat of zinc chromate primer and one (1) heavy coat of aluminum pigmented asphalt paint on each surface; or where deemed necessary by the Engineer, not less than one (1) course of asphalt saturated cotton fabric cemented to both metals with flashing cement, shall be used. Finished works shall be cleaned and excess cement, shall be used. Finished works shall be cleaned and excess cement removed. All work shall be adequately anchored in place at proper elevations, planes and locations.

END OF SECTION

SECTION 05530

ALUMINUM GRATING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, and incidentals required to install the aluminum grating, the structural members supporting the grating and the angles, connections, fastenings and concrete inserts attached to or supporting the grating, or those structural members as shown on the Drawings, or specified herein.
- B. Related Work Specified Elsewhere: Items specified in this Sections which are to be embedded in concrete are to be furnished as part of the work of this Section, but their installation is a part of the work in Division 3.

1.02 STANDARDS

- A. Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements and recommendations of the following standards:
 - 1. Metal Bar Grating Manual - 1974 of the National Association of Architectural Metal Manufacturers.
 - 2. Aluminum Construction Manual, Section 3, third edition 1975 of the Aluminum Association.

1.03 SUBMITTALS

- A. Complete fabrication and erection drawings showing all components of the aluminum grating system shall be submitted for review in conformance with Section 01340: Shop Drawings, Working Drawings and Samples. Fabrication shall not begin until Engineer's review is complete.

PART 2 - PRODUCTS

2.01 ALUMINUM GRATING

- A. Configuration: Grating shall be pressure-locked aluminum having I-shaped bearing bars spaced at 1/4-inches on centers and sized as indicated on the Drawings. Cross bars shall be spaced at 4-inches on centers. All grating surfaces shall be "slip-resistant" serrated type.

- B. Material: Bearing bars shall be of extruded aluminum meeting all requirements of ASTM B-221-76, alloy 6061-T6 or 6063-T6. Cross bars shall be drawn or extruded aluminum meeting all requirements of ASTM B-210-76 or B-221-76.
- C. Anchors shall be stainless steel saddle clips.
- D. Fabrication shall meet all requirements of the NAAMM Metal Bar Grating Manual. Finish shall be mill finish.
- E. Aluminum Grating System shall be designed for a live load of 60 pounds per square foot of gross projected area with deflection not-to-exceed 1/360 of span.

2.02 ALUMINUM SHAPES

- A. Configuration: Shapes shall be as indicated on the Drawings and as detailed in Section 3 of the Aluminum Construction Manual.
- B. Material: Shapes shall meet all requirements of ASTM B-209 or B-308 for alloy 6061 T6.

2.03 ALUMINUM FASTENINGS

- A. Aluminum fasteners shall not be permitted. All connections of aluminum to aluminum shall be stainless steel as required under Paragraph 2.05, herein.

2.04 STAINLESS STEEL SHAPES

- A. Members supporting FRP grating or members embedded in concrete at the Pretreatment Structure shall be stainless steel plate AISI Type 304 formed as indicated. Anchor straps shall be stainless steel shop welded to the stainless steel shapes.

2.05 STAINLESS STEEL FASTENINGS

- A. Connections of stainless steel to aluminum or concrete shall be stainless steel bolts of AISI Type 304. Nuts shall be AISI Type 430 stainless steel.

PART 3 - EXECUTION

3.01 FIELD INSPECTION

- A. Prior to beginning installation, a thorough investigation shall be made of the structure to receive the system to insure that the system can be installed to the indicated alignment. Installation shall not be started until that surface is satisfactory.

3.02 INSTALLATION

- A. The aluminum grating system shall be installed as indicated on the Drawings and Shop Drawings.

END OF SECTION

SECTION 06176

METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood roof trusses.
 - 2. Wood truss bracing.
 - 3. Metal truss accessories.
- B. Related Sections include the following:
 - 1. Division 6 Section "Sheathing" for roof sheathing and subflooring.

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.
- B. TPI: Truss Plate Institute, Inc.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.
 - 4. WCLIB: West Coast Lumber Inspection Bureau.
 - 5. WWPA: Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: All applicable dead loads and the appropriate Live loading
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/240 of span.

1.5 SUBMITTALS

- A. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses.

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
- B. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- C. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.

- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

- A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1.

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633,

2.4 METAL TRUSS ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements.
- B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those of basis-of-design products.
- C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
- D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall below sufficient for design loads.

2.5 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

- F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- I. Install wood trusses within installation tolerances in TPI 1.
- J. Do not cut or remove truss members.
- K. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.

3.2 REPAIRS AND PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION

SECTION 06605

FABRICATED FIBERGLASS REINFORCED PLASTIC PRODUCTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This specification covers fiberglass reinforced plastic products for use in wastewater treatment plants. Applications include, but are not limited to: Weir plates, scum baffle plates, liquid level indicators, ventilators, hatch covers, and ladders.

1.02 QUALIFICATIONS AND EXPERIENCE OF THE MANUFACTURER

- A. The manufacturer shall be a specialist in the design and fabrication of fiberglass reinforced plastic products intended for use in wastewater applications, and shall have at least five years experience in this specialty.
- B. The manufacturer shall have such production facilities as will insure prompt manufacture and shipment of these fiberglass products. The manufacturer shall continually monitor production in order to insure that the control of quality is maintained. Upon request, the manufacturer shall furnish certified test reports on the raw materials used in fabrication.
- C. The manufacturer shall have on it staff a full-time registered Professional Engineer having no less than five years experience in the design and fabrication of fiberglass reinforced plastic products, who will be in responsible engineering charge of the work to be done. All shop drawings shall carry the seal of such registered Professional Engineer.

1.03 DESIGN

- A. The assembled fiberglass reinforced plastic products and each of their structural components, both laminated and prefabricated, shall be designed for all live and dead loads, including 120 miles per hour wind. Empirical designs of assembled fiberglass reinforced plastic products shall be acceptable provided they are substantiated by a satisfactory service history of no less than 10 years.

1.04 GUARANTEE

- A. The manufacturer shall guarantee workmanship and materials on the finished fiberglass reinforced plastic products for a period of five years from date of acceptance of the work. In case defects appear within the five-year period, the

manufacturer shall proceed to make repairs promptly upon written notice from the Owner that such defects have been found.

1.05 SHOP DRAWINGS

- A. Prior to beginning fabrication, the manufacturer shall submit a complete set of detailed shop drawings for the products to be furnished in accordance with Section 01340 Shop Drawings, Working Drawings and Samples. Drawings shall indicate specific dimensions and thicknesses. Drawings must be approved before production may proceed.

1.06 APPROVALS

- A. The manufacturer shall secure from the appropriate regulatory agencies, approval for the use of its fiberglass reinforced plastic products for use in potable water applications, if required by the Project.

PART 2 - MATERIALS

2.01 RESINS

- A. Polyester Resin:

General purpose polyester resin, Reichhold Polylite 33-084, or equal, shall be used. The resin shall be of a commercial grade that has been evaluated by testing or previous service, and found to be acceptable for the specific environment. The resin shall be resistant to the corrosive action of water and wastewater.

- B. Catalyst:

The polyester resin shall be cured by polymerization, resulting in a hard, rigid, solid product. The catalyst used for polymerization shall be MEK peroxide, Reichhold 46-700 or equal.

- C. Gel Coat:

Gel coat shall consist of polyester resin, a catalyst, and a colorant. White gel coat shall be Ferro VF-4060 or equal. Green gel coat shall be Ferro VF-8640 or equal.

2.02 GLASS FIBER REINFORCING MATERIALS

- A. Glass fiber reinforcing materials shall be of commercial grade. To insure chemical adherence between the glass reinforcement and the polyester resin, a special silane treatment shall be applied to the glass filaments. One or more of the following glass fiber reinforcing materials shall be used:

1. Chopped Roving:

Multiple strands of monofilament glass fibers made into a continuous untwisted ribbon and automatically chopped to approximately 1-inch lengths, and placed by machine in the spray-up method of fiberglass manufacture.

2. Reinforcing Mat:

Made from roving chopped to approximately 2-inch lengths, then uniformly dispersed and manufactured into a smooth mat with weights ranging from 3/4 oz. to 1-1/2 oz. per square foot, suitable for the hand lay-up method of fiberglass manufacture. In the manufacture of reinforcing mat, the glass strands shall be bonded together into the mat shape with a styrene soluble binder.

3. Woven Roving:

Made from continuous roving, and woven into a heavy fabric suitable for the hand lay-up method of fiberglass manufacture.

4. Woven Cloth and Tape

Made from twisted yarns of glass fiber strands, and woven into a light fabric suitable for the hand lay-up method of fiberglass manufacture.

2.03 LAMINATED FIBERGLASS COMPONENTS

A. Laminate Construction:

Laminated fiberglass components shall be manufactured by a combination of the spray-up method and the hand lay-up method.

The laminate shall consist of a series of resin and glass reinforcement applied upon a mold made specifically for the end product being manufactured. The surface of the mold shall be free of cracks, pits, and crazing. The mold shall have a smooth finish.

The initial coating placed against the mold shall be a gel coat 20 to 25 mils thick. VF-4060 white gel coat shall be used for molded surfaces which will be exposed to weather. VF-8640 green gel coat shall be used for molded surfaces which will be exposed to wastewater.

The second layer in the laminate shall be no less than 25 mils thick and shall consist of polyester resin reinforced with no less than 30 percent chopped roving and reinforcing mat.

The remaining thickness of the laminate shall be designed and manufactured to provide the strength necessary to meet tensile and flexural requirements and shall consist of layers of polyester resin and any one of a combination of glass fiber reinforcing materials described under Paragraph 2.02.

If multiple layers of woven roving or woven cloth are used, a layer of chopped roving shall be placed in alternate layers.

The glass fiber content of the completed laminate shall be no less than 30 percent by weight. Throughout the laminate, the resin shall thoroughly saturate the glass fiber reinforcement.

B. Laminate Appearance:

The fiberglass product shall be of uniformly high quality. The finished molded surface shall be free of visual defects, foreign inclusions, dry spots, crazing, air bubbles, pin holes and delaminations. Edges shall be straight and true.

The finished lay-up surface shall be smooth and shall be thoroughly coated with gel coat. There shall be no exposed glass fibers or sharp projections. All cut edges shall be straight, and shall be coated with gel coat so that no glass fibers are exposed, and so that all voids are filled.

C. Laminate Thickness:

The fiberglass reinforced plastic laminate shall have a thickness of no less than ¼-inch. At no point in the laminate shall the thickness be less than this minimum.

D. Laminate Properties:

The fiberglass reinforced plastic laminate shall have the following physical properties, and where required, shall be tested in accordance with the ASTM standards indicated:

Physical Property	Value	ASTM Standard
Specific Gravity:	1.5	D792
Water Absorption, 24 Hrs.:	0.50%	D570
Ultimate Flexural Strength:	20,000 psi	D790
Ultimate Tensile Strength:	20,000 psi	D638
Ultimate Compressive Strength:	20,000 psi	D695
Ultimate Shear Strength	10,000 psi	D732

Design of all components shall use a factor of safety of 4.0 based on the ultimate strength.

The average Barcol hardness of the laminate shall be no less than 30. Barcol Impressor Model GYZJ 934-1 shall be used for determining hardness. Calibration of the Barcol instrument shall be verified by comparing with a blank specimen having a known hardness reading of 85-87. For each fiberglass component, 10 readings on the clean laminate surface shall be made. After eliminating the two high and two low readings, the average of the remainder shall be the reported hardness reading.

2.04 PREFABRICATED FIBERGLASS STRUCTURAL COMPONENTS

- A. Prefabricated structural components used in the manufacture of all fiberglass products shall be made of polyester resin reinforced with glass fibers and produced by a continuous forming process.
- B. Prefabricated structural components shall have the following physical properties:

Physical Property	Value	ASTM Standard
Specific Gravity:	1.52	D792
Water Absorption, 24 Hrs.:	0.75%	D570
Barcol Hardness:	50	--
Ultimate Tensile Strength:	20,000 psi	D638
Ultimate Compressive Strength:	20,000 psi	D695
Ultimate Shear Strength:	3,000 psi	D732

- C. Design of all components shall use a factor of safety of 4.0 based on the ultimate strength.

2.05 FASTENERS

- A. All fasteners used in the assembly and erection of fiberglass reinforced plastic products shall be Type 316 stainless steel. A ratio of fastener diameter to fiberglass thickness (D/t) of no less than one (1) shall be used.

2.06 POLYCARBONATE ROOFING PANELS

- A. All roofing panels for the sludge drying bed cover shall be UV resistant polycarbonate material of 1/16-inch in thickness.
- B. The polycarbonate panel material shall be clear and translucent and allows 90% light transmission.
- C. The polycarbonate panel material shall not change its color, flexibility, strength, or integrity within 5 years.
- D. H&F Manufacturing Corp. Model Unitrex Sunsky or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All work shall be erected level and plumb, and shall meet required heights, layout and details precisely. All work shall be adequately fastened, anchored or braced. All fasteners shall be Type 316 stainless steel.
- B. All work shall be executed in accordance with the best practices of the trade, by persons skilled in the craft.
- C. Installation shall be in strict accordance with manufacturer's instructions and recommendations. Fiberglass products shall be installed at the locations shown on the Drawings.

3.02 INSPECTION AND TESTING

- A. Final acceptance test shall demonstrate that products have been properly installed, are structurally sound and secure, and are in correct alignment.

END OF SECTION

SECTION 07842

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Sections:

1. Division 5 Section "Architectural Joint Systems" for fire-resistive architectural joint systems.
2. Division 7 Section "Through-Penetration Firestop Systems" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For fire-resistive joint systems, including printed statement of VOC content.

- C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

- D. Qualification Data: For qualified Installer.

- E. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fire-resistive joint systems.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."
- B. Installer Qualifications: A firm experienced in installing fire-resistive joint systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its fire-resistive joint system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Fire-resistive joint systems shall comply with the following requirements:
 - 1. Fire-resistive joint system tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per testing standard referenced in "Fire-Resistive Joint Systems" Article. Provide rated systems complying with the following requirements:
 - a. Fire-resistive joint system products bear classification marking of qualified testing agency.
 - b. Fire-resistive joint systems correspond to those indicated by reference to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure fire-resistive joint systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's testing agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where required, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:
 - 1. Joints include those installed in or between fire-resistance-rated walls and roofs or roof/ceiling assemblies.
 - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.
 - 3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A/D Fire Protection Systems Inc.
 - b. CEMCO.
 - c. Fire Trak Corp.
 - d. Grace Construction Products.
 - e. Hilti, Inc.
 - f. Johns Manville.
 - g. Nelson Firestop Products.
 - h. NUCO Inc.
 - i. Passive Fire Protection Partners.
 - j. RectorSeal Corporation.
 - k. Specified Technologies Inc.
 - l. 3M Fire Protection Products.
 - m. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - n. USG Corporation.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide fire-resistive joint systems with rating determined by ASTM E 119 based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa) or ASTM E 2307.
 - 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A/D Fire Protection Systems Inc.
 - b. Grace Construction Products.
 - c. Hilti, Inc.
 - d. Johns Manville.
 - e. Nelson Firestop Products.
 - f. NUCO Inc.
 - g. Passive Fire Protection Partners.
 - h. RectorSeal Corporation.
 - i. Specified Technologies Inc.
 - j. 3M Fire Protection Products.
 - k. Thermafiber, Inc.
 - l. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - m. USG Corporation.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.
1. L-Rating: Not exceeding 5.0 cfm/ft (0.00775 cu. m/s x m) of joint at 0.30 inch wg (74.7 Pa) at both ambient and elevated temperatures.
 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A/D Fire Protection Systems Inc.
 - b. Grace Construction Products.
 - c. Hilti, Inc.
 - d. Johns Manville.
 - e. Nelson Firestop Products.
 - f. NUCO Inc.
 - g. Passive Fire Protection Partners.
 - h. RectorSeal Corporation.
 - i. Specified Technologies Inc.
 - j. 3M Fire Protection Products.
 - k. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - l. USG Corporation.
- E. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide fire-resistive joint systems that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 3. Sealant Primers for Porous Substrates: 775 g/L.

- G. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to maintain ratings required. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify fire-resistive joint systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or fire-resistive joint systems are damaged or removed due to testing, repair or replace fire-resistive joint systems so they comply with requirements.
- C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION

SECTION 08331

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Service doors.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
- C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- D. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 - 3. For fire-rated doors, description of fire-release system including testing and resetting instructions.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Show locations of replaceable fusible links.
 - 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - 1. Include similar Samples of accessories involving color selection.
- D. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of seismic restraints.
 - 2. Summary of forces and loads on walls and jambs.
- E. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 0.028 inch (0.71 mm) and as required to meet requirements.
 - 2. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm) and as required to meet requirements.
 - 3. Aluminum Door Curtain Slats: ASTM B 209 (ASTM B 209M) sheet or ASTM B 221 (ASTM B 221M) extrusions, alloy and temper standard with manufacturer for type of use

and finish indicated; thickness of 0.050 inch (1.27 mm) and as required to meet requirements.

- B. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
 - a. for each cylinder.
- 2. Thresholds: Equip pass doors with integral thresholds that comply with egress and accessibility requirements of authorities having jurisdiction.

2.2 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.
 - 2. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
 - 3. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B 209 (ASTM B 209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.
 - 4. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.
 - 5. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.3 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.4 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).
- C. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 30 lbf (133 N) force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.
- D. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 30 lbf (133 N) force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.5 DOOR ASSEMBLY

- A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
 - a. ACME Rolling Doors.
 - b. Alpine Overhead Doors, Inc.
 - c. AlumaTek, Inc.
 - d. C.H.I. Overhead Doors.
 - e. City-Gates.
 - f. Cookson Company.
 - g. Cornell Iron Works, Inc.
 - h. Dynamic Closures Corp.
 - i. Lawrence Roll-Up Doors, Inc.
 - j. Mahon Door Corporation.
 - k. McKeon Rolling Steel Door Company, Inc.
 - l. Metro Door.
 - m. Overhead Door Corporation.
 - n. QMI Security Solutions.
 - o. Raynor.
 - p. Southwestern Steel Rolling Door Co.
 - q. Wayne-Dalton Corp.
 - r. Windsor Door.

3.

B. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as indicated by manufacturer's designations.
2. Factory Prime Finish: Manufacturer's standard color.
3. Stainless-Steel Finish: No. 2B (bright, cold rolled).
4. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

- A. Mill Finish: Manufacturer's standard.

2.8 STEEL AND GALVANIZED-STEEL FINISHES

- A. Factory Prime Finish: Manufacturer's standard primer, compatible with field-applied finish. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.
- B. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

2.9 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 3. Directional Satin Finish: No. 4.
- C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- D. Fire-Rated Doors: Install according to NFPA 80.
- E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08350

ACCESS HATCH DOORS

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This Section includes providing all labor, materials and equipment necessary to install the access hatch doors on the various valve vaults, flowmeter vaults, effluent transfer wetwell and the pump station wetwells, and sludge processing basins as indicated on the Drawings and/or specified herein.

1.02 QUALITY ASSURANCE

- A. Standards: The access doors shall meet the standards of the following:
 - 1. Standard Building Code
 - 2. OSHA Requirements
- B. Manufacturers: Halliday Products, Orlando, Florida; U.S. Foundry and Manufacturing Corp., Miami, Florida; The Bilco Company, New Haven, Connecticut; or approved equal.

1.03 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be submitted to the Engineer for approval. Shop drawings shall include manufacturer's data sheets showing all materials, connections and other required details to illustrate a complete operating access door. Refer to Division 1, Section 01340, for the specific requirements of the submittal.

1.04 WARRANTY AND GUARANTEE

- A. The manufacturer shall guarantee the access door against defects in material and workmanship for a period of five (5) years. Refer to Section 01740 for requirements.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The access doors, in sizes as shown on the Drawings, shall be the standard design of the manufacturer.

2.02 MATERIALS

- A. Each hatch shall be designed according to the openings shown on the Drawings. The aluminum access frames shall be manufactured from 1/4-inch thick, one-piece extruded aluminum frame. The frame shall be a self-draining channel with a 1 1/2-inch draining coupling located in the channel frame. The door panels shall close flush and shall be 1/4-inch thick aluminum diamond (checker) plate. The installed access doors shall be designed to withstand a minimum live load of 300-pounds per square foot. Access doors shall be designed with a safety factor of 3.0. Removable aluminum cross-beams shall be provided by the hatch supplier as required to accomplish the stated loading. The doors shall have heavy-duty stainless steel butt hinges with tamper-proof fasteners. All hardware shall be made of Type 316L stainless steel. Each door shall have spring operators, such that the maximum lifting effort is less than 25-pounds. The hatch supplier shall provide the number of spring operators as required to accomplish the maximum lifting requirement. Each door shall open to 90° and lock automatically with a stainless steel, positive locking arm and a stainless steel release handle. Each door shall have a recessed stainless steel lifting handle. The hatch shall be provided with a Type 316 stainless steel snap-lock with a removable handle.
- B. All access doors shall be designed with a neoprene gasket on the inside lip of the frame perimeter, to form an essentially air-tight seal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The access hatches and doors shall be installed as recommended by the manufacturer and adjusted for proper operation without binding.
- B. Edges of the aluminum frame that will be in contact with concrete, shall be coated with coal tar epoxy prior to casting into the concrete, in accordance with Section 09900: Painting.

END OF SECTION

SECTION 08712

DOOR HARDWARE (SCHEDULED BY DESCRIBING PRODUCTS)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware.
2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. See Division 8 door sections for astragals and door silencers.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Details of electrified door hardware including wiring diagrams.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

B. Deliver keys to Owner by registered mail or overnight package service.

1. Columbia County, County Manager

1.4 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion, except as follows:

1.6 EXTRA MATERIALS

- A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware:

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.

- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

2.2 HINGES, GENERAL

- A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

- B. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: Stainless steel, with stainless-steel pin.
2. Interior Hinges: Stainless steel, with stainless-steel pin.
3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

2.3 HINGES

- A. Template Hinge Dimensions: BHMA A156.7.

- B. Available Manufacturers:

1. Baldwin Hardware Corporation.
2. Bommer Industries, Inc.

3. Cal-Royal Products, Inc.
4. Hager Companies.
5. Lawrence Brothers, Inc.
6. McKinney Products Company; an ASSA ABLOY Group company.
7. PBB, Inc.
8. Stanley Commercial Hardware; Div. of The Stanley Works.

2.4 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 1. Bored Locks: BHMA A156.2.
 2. Mortise Locks: BHMA A156.13.
 3. Interconnected Locks: BHMA A156.12.
 4. ASSA ABLOY Group company.

2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.
 1. Existing System: Master key or grand master key locks to Owner's existing system.
 2. Existing System: Re-key Owner's existing master key system into new keying system.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

C. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

G. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

END OF SECTION

SECTION 08900
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum and formed-metal louvers.
2. Adjustable, extruded-aluminum and formed-metal louvers.
3. Wall vents (brick vents).

B. Related Sections:

1. Division 04 Section "Unit Masonry" for building wall vents (brick vents) into masonry.
2. Division 08 Section "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
3. Division 08 Section "Flush Wood Doors" for louvers in flush wood doors.
4. Division 09 Section "Exterior Painting" for field painting louvers.
5. Division 26 Sections for electrical power connections for motor-operated adjustable louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver

blade rattle or flutter, or permanent damage to fasteners and anchors. Florida Building Code wind pressures for Columbia County Florida shall be considered to act normal to the face of the building.

- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
 - 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 - 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 - 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide or extended sills for recessed louvers.

2.3 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09900

PAINTING

PART I - GENERAL

1.01 DESCRIPTION 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. All surfaces described shall be included within the scope of this Section.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces such as ceilings, walls, floors, miscellaneous metal, doors, frames, transoms, roof fans, construction signs, guardrails, posts, 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. The following major items of the Project, when applicable, shall be coated:
 - 1. Interior of building gypsum wallboard walls, interior cast-in-place concrete and concrete block walls, and exterior concrete block walls. This shall include the Administrative Building, the Chlorination and Storage Building, and the Blower Building.
 - 2. Interior of all concrete water-retaining structures including the headworks structure, sequential batch reactor (SBR) tankage, SBR effluent equalization tank, chlorine contact chamber, ground storage tank, sludge digester, in-plant wastewater wet well, sludge drying beds, pump station wet well, valve vault, meter vaults, and sanitary manholes.
 - 3. Exterior of buried concrete structures including the pump station wet wells and manholes.
 - 4. Submerged surfaces, surfaces exposed to wastewater, and surfaces in wet wells, valve vaults and meter vaults of any ferrous metal and aluminum components of equipment, piping, fittings and valves (except stainless steel).
 - 5. Exposed ferrous surfaces of equipment, pumps, motors, tanks and ferrous or galvanized metal fittings and accessories.
 - 6. Exposed surfaces of PVC components of piping, fittings, valves, electrical conduit, and equipment.

7. Exposed exterior surfaces of all metallic piping, fittings, and valves located on the interior and exterior of buildings and structures.
 8. Embedded aluminum, or aluminum in contact with dissimilar metals, or in contact with corrosive atmospheres.
- C. "Paint" as used herein means all coating systems, materials, including primers, emulsions, enamels, epoxies, sealers and fillers, and other applied materials whether used as a prime, intermediate, or finish coats.
- D. The following items will not be painted unless otherwise noted:
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, sensing devices, motor and fan shafts, unless otherwise indicated.
 3. Traffic stripes on paving are specified in Division 2: Site Work.
 4. Aluminum or fiberglass handrails, walkways, toeboards, windows, louvers, grating, checker plate, hatches, and stairways.
 5. Stainless steel angles, tube, pipe, etc.
 6. Products with polished chrome, aluminum, nickel, or stainless steel finish.
 7. Stainless steel, brass, bronze, and aluminum other than exposed utility tubing.
 8. Flexible couplings, lubricated bearing surfaces, insulation, and plastic pipe or duct interiors.
 9. Plastic switch plates and receptacle plates.
 10. Signs and nameplates.
 11. Finish hardware.
 12. Packing glands and other adjustable parts, unless otherwise indicated.
 13. Portions of metal, other than aluminum, embedded in concrete. This does not apply to the back face of items mounted to concrete or masonry surfaces, which shall be painted before erection. Aluminum to be

embedded in, or in contact with, concrete shall be coated to prevent electrolysis.

1.02 RELATED WORK

- A. Paint piping and equipment for identification purposes in accordance to Section 09905: Piping and Equipment Identification System.

1.03 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 will not be acceptable.
- B. Provide undercoat paint produced by the same manufacturer as the finish coats. Undercoat and finish coat paints shall be compatible. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
- C. Painting shall be accomplished by experienced painters specializing in industrial painting familiar with all aspects of surface preparations and applications required for this project. Work shall be done in a safe and workmanlike manner.
- D. Standards:
 - 1. ASTM.
 - 2. OSHA.
 - 3. NFPA.
 - 4. SSPC.
 - 5. NACE.
 - 6. NSF.
 - 7. AWWA.

E. Acceptable Manufacturers:

1. Carboline Company.
2. Tnemec Company, Inc.
3. Keeler & Long, Inc.
4. Porter International.

1.04 SUBMITTALS

A. Materials and Shop Drawings: Submit to the Engineer as provided in the General Conditions and Section 01340: Shop Drawings, Working Drawings and Samples, shop drawings, manufacturer's specifications and data on the proposed paint systems and detailed surface preparation, application procedures and dry film thickness (DFT).

B. Schedule:

1. The Contractor shall submit for approval a complete typewritten Schedule of Painting Operations within 90-days after the Notice to Proceed. This Schedule is imperative so that the various fabricators or suppliers may be notified of the proper ship prime coat to apply. It shall be the Contractor's responsibility to properly notify and coordinate the fabricators' or suppliers' surface preparation and painting operations with these specifications. This Schedule shall include for each surface to be painted, the brand name, generic type, solids by volume, application method, the coverage and the number of coats in order to achieve the specified dry film thickness, and color charts. When the Schedule has been approved, the Contractor shall apply all material in strict accordance with the approved Schedule and the manufacturer's instructions. Wet and dry paint film gauges may be utilized by the Owner or Engineer to verify the proper application while work is in progress.
2. It is the intent of this Section that, as much as possible, all structures, equipment, and piping utilize coating systems specified herein supplied by a single manufacturer. All exceptions must be noted on the Schedule. For each coating system, only one (1) manufacturer's product shall be used.
3. Requests for substitutions shall be made within ten (10) days of Bid and shall include all of the information required in the Schedule plus a signed and notarized statement from the Chief (Manufacturing) Chemist that the products listed are equal to the specified products, test results, and a list of ten (10) municipal wastewater plant projects where each product has been used and provided satisfactory service for at least ten years. No request for

substitution shall be considered that would change the generic type of coating, decrease DFT, or decrease number of coats.

Test result submittals shall be certified by a qualified testing laboratory. A quality of paint that is measured by analytical written ASTM/Federal test procedures will provide assurances that quality products are utilized.

The results from the following testing procedures shall be submitted for determining quality:

- a. Abrasion: Federal Test Method Std. No. 141, Method 6192, CS-17 Wheel, 1,000 gram load.
 - b. Adhesion: Elcometer Adhesion Tester (0 to 1000 psi).
 - c. Exterior Exposure: Exposed at 45 degrees facing ocean (South Florida Marine Exposures).
 - d. Hardness: ASTM D-3363, latest revision.
 - e. Humidity: ASTM D-2247, latest revision.
 - f. Salt Spray (Fog): ASTM B-117, latest revision.
- C. Color Samples: Manufacturer's standard color charts for color selection by Owner.
- D. Samples - Painting:
1. Paint colors will be selected by Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.
 2. Samples of each finish and color shall be submitted to the Owner or 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 three (3) coat work is specified, the sample shall be divided into three (3) areas:
 - a. One (1) showing the application of one (1) coat only.
 - b. One (1) showing the application of two (2) coats.
 - c. One (1) showing the application of all three (3) 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.
- E. The Contractor shall submit to the Owner, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to coat all surfaces, in accordance with the requirements or this Section. Such certification shall make reference to square footage figures provided to the manufacturer by the Contractor.

1.05 DELIVERY, HANDLING AND STORAGE

- A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and label in accordance with Section 01600: Materials and Equipment.
1. Provide labels on each container with the following information:
 - a. Name or title of material.
 - b. Fed. Spec. number if applicable.
 - c. Manufacturer's stock number, date of manufacture and expiration date (shelf life).
 - d. Manufacturer's formula or specification number.
 - e. Manufacturer's batch number.
 - f. Manufacturer's name.
 - g. Generic type.
 - h. Contents by volume, for major pigment and vehicle constituents.
 - i. Application instructions: thinning, ambient conditions, etc.
 - j. Color name and number.
 2. Containers shall be clearly marked to indicate any hazards connected with the use of the paint and steps, which 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 Owner shall designate areas for storage and mixing of all painting materials. Store only acceptable product materials on project site. Restrict storage to paint materials and related equipment. Storage of paint materials and related equipment shall comply with the requirements or pertinent codes and fire regulations. In addition, all safety precautions noted on the manufacturer's Material Safety Data Sheets and other literature shall be strictly followed. Proper containers outside of buildings 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.

1.06 WARRANTY AND GUARANTEES

- A. Refer to Section 01740: Warranties and Bonds.
- B. All paint and coatings work performed under these specifications shall be guaranteed by the coatings applicator for 100 percent of the total coated area for both materials and labor against failures during the warranty period.
- C. Failure under this warranty shall include flaking, peeling, or delaminating of the coating due to aging, chemical attack, or poor workmanship; but it shall not include areas, which have been damaged by unusual chemical, thermal, or mechanical abuse.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All paint shall be manufactured by one of the suppliers listed in Paragraph 1.03E. herein, and shall be their highest grade of paint.
- 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 as described in Paragraph 1.04, herein. When other than the specified coating system is proposed, the Contractor shall submit on 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. Shop paint shall be of the same type and manufacture as used for field painting by the Contractor.
- 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 painter's rags, completely sterilized.

2.02 COATING SYSTEMS

- A. Class 1 Exposures - Exposed Concrete and Masonry, Interior, Non-immersion excluding Floors.
 - 1. Examples of this classification include the following surfaces in the Operations/Lab Building, Chemical Storage Building, Lime Silo Building, and Electrical Building:
 - a. Interior masonry and plaster.
 - b. Concrete block walls.
 - c. Concrete walls, columns, and supports.
 - d. Concrete ceilings and beams.
 - 2. Surface Preparation: As specified in Paragraph 3.02, herein, including filling cracks, voids, and other surface imperfections, removing mortar droppings, cleaning, and air-blasting.
 - 3. Class 1 Coating System:
 - a. Prime Coat: Epoxy Polyamide Filler for Concrete Block
 - (1) Kop Coat Epoxy Block Filler: One (1) coat at 75 to 100 sq. ft./gal. Actual coverage may be less than the minimum stated depending on the porosity of the substrate to be coated.
 - b. Finish Coats: Epoxy Polyamide or Amine-Cure (Glossy):

- (1) Carboline 890: Two (2) coats at 6 to 8 mils DFT each coat for a minimum total finish thickness of 14 mils DFT.

**NOTE: MAXIMUM ELAPSED TIME BETWEEN
COATS, AS STATED BY THE COATING
MANUFACTURER, SHALL NOT BE
EXCEEDED.**

B. Class 2 Exposures - Exposed Concrete, Immersion, Non-Potable
(Black finish color only):

1. Class 2 exposures shall consist of all precast or cast-in-place reinforced concrete that is subject to exposure to continuous or intermittent immersion in wastewater, wastewater splashing, or wastewater gases. Structures and surfaces to be coated include the following:
 - a. Coat the entire concrete interior including floors, ceilings, and walls (entire wall height) of the interior surfaces of the sludge processing tanks, splitter box, scum pump station wetwell, in-plant pump station wetwell, valve vault, meter vault, and sanitary manholes.
 - b. Coat the exposed concrete interior including ceilings, columns, beams, walls (from the top of the wall to 24-inches below the basin low water level) of the interior surfaces of the BNR process tankage, and filters (except the launders).
 - c. Coat the concrete interior including dome and walls (24-inch upper most portion) of the reuse storage tank.
2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
 - a. Abrasive blast cleaning to remove laitance and roughen the entire surface equivalent to the surface of No. 80 grit sandpaper.
 - b. Concrete surfaces shall be patched to produce a consistent, void free surface, eliminating all air pockets, pinholes, bug holes, tie holes, form fins and burrs, honeycombs and cracks. Patching compound shall be a sand/portland cement mixture with a liquid, acrylic-polymer bonding additive equal to Master Builders Acryl-Set Liquid Polymer.
 - c. After surface patching remove remaining laitance or other debris by high-pressure water blasting. Prior to application of coating system, surfaces shall be clean and dry.

3. Class 2 Coating System:

- a. Prime Coat: Polyamide cured coal tar epoxy thinned 33 percent by volume.
Kop Coat Bitumastic No. 300-M: One coat, 4 mils DFT.
- b. Finish Coats: Polyamide cured coal tar epoxy.
Kop Coat Bitumastic No. 300-M: Two (2) coats, 10 mils DFT per coat. Finish coats shall alternate colors as red-black.
- c. Total minimum system finish coating thickness shall be 24 mils DFT.

**NOTE: MAXIMUM ELAPSED TIME BETWEEN
COATS, AS STATED BY THE COATING
MANUFACTURER, SHALL NOT BE EXCEEDED.**

C. Class 3 Exposures - Exposed Concrete, Immersion, Non-Potable (Colored Finish)

1. Class 3 exposures shall consist of all cast-in-place reinforced concrete that is subject to continuous or intermittent immersion in wastewater, wastewater splashing or wastewater gases where a color other than black is required. Coat the entire concrete interior including floors, ceilings and walls (entire wall height). Structures to be coated include the following:
 - a. Interior surfaces of concrete for the secondary clarifiers effluent launders, filters effluent launders, chlorine contact chamber (excluding floors), and effluent transfer and wetwell (excluding floors).
2. Surface Preparation: Same as required for Class 2 exposure surface preparation specified in Paragraph 2.02.B.2 above.
3. Class 3 Coating System.
 - a. Prime Coat: Two component, cross lined epoxy thinned 12 percent by volume.

Carboline Super Hi-Gard 891 thinned 12 percent with Carboline Thinner #33: One (1) coat, 4 mils DFT.
 - b. Finish Coats: Two component, cross-linked epoxy.
Carboline Super Hi-Gard 891: Three (3) coats, 8 mils DFT per coat. Finish coat color shall be white.
 - c. Total minimum system finish coating thickness shall be 28 mils DFT.

**NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS,
AS STATED BY THE COATING MANUFACTURER,
SHALL NOT BE EXCEEDED.**

D. Class 4 Exposures - Buried Exterior Concrete Surfaces

1. Class 4 exposures consist of all exterior below grade surfaces for precast and/or cast-in-place concrete structures, all exterior concrete footings below grade and shall include the following:
 - a. Exterior below grade surfaces of precast and/or cast-in-place concrete wetwells (in-plant pump station) and sanitary manholes.
2. Surface Preparation: Same as required for Class 2 exposure surface preparation specified in Paragraph 2.02.B.2 above.
3. Class 4 Coating System
 - a. Prime Coat: Polyamide cured coal tar epoxy thinned 33 percent by volume.
Kop Coat Bitumastic No. 300-M: One (1) coat, 4 mils DFT.
 - b. Finish Coats: Polyamide cured coal tar epoxy.
Kop Coat Bitumastic No. 300-M: Two (2) coats, 10 mils DFT per coat. Finish coats shall alternate colors as red-black.
 - c. Total minimum system finish coating thickness shall be 24 mils DFT.

**NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS,
AS STATED BY THE COATING MANUFACTURER,
SHALL NOT BE EXCEEDED.**

E. Class 5 Exposures - Concrete and Masonry, Exterior, Non-Immersion

1. Class 5 exposures consist of exposed exterior concrete and masonry surfaces of buildings subjected to normal exterior elements and not subjected to wastewater immersion or contact. Class 5 exposures shall include the following:
 - a. Exterior concrete and masonry surfaces for the Operations/Lab Building, Chemical Storage Building, Lime Silo Building, Electrical Building, Entrance Sign, Dumpster Enclosure (exterior and interior), and transformer vault (exterior and interior).
2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:

- a. Masonry surfaces shall be prepared by filling cracks, voids and other surface imperfections, removing mortar droppings, cleaning and high pressure water blasting.
 - b. Concrete surfaces shall be prepared as required for Class 2 exposure surface preparation specified in Paragraph 2.02.B.2 above.
3. Class 5 Coating System
 - a. Prime Coat for Masonry Structures: waterborne cementitious acrylic masonry block filler, Tnemic Series 130-6602 (off-white) Envirofill Masonry Block Filler: One (1) coat at 80 to 100 square feet per gallon. Actual coverage may be less than the minimum stated depending on the porosity of the substrate to be coated.
 - c. Finish Coats: A Modified Waterborne Acrylic Elastomeric Coating. Tnemic Series 156 Enviro-Crete: Two (2) coats, 5 mils DFT per coat for a total thickness of 10 mils DFT.

F. Class 6 Exposures - Gypsum Wallboard (Interior)

1. Class 6 exposures consist of interior gypsum wallboard surfaces of buildings and shall include the following surfaces:
 - a. Gypsum wallboard walls in the Operations/Lab Building identified as P-1, P-2, P-3, and P-4 in the Architectural Finish Schedule.
2. Surface preparation: As specified in Paragraph 3.02 herein including filling cracks, voids, and other surface imperfections with patching paste, sanding rough and high spots, and cleaning surfaces.
3. Class 6 Coating System (Surfaces identified as P-1 and P-4)
 - a. Prime Coat: Single component waterborne acrylic primer/sealer. Carboline Multi-Bond 120: One (1) coat, 1 to 2 mils DFT per coat.
 - b. Finish Coats: High quality acrylic latex. Carboline 3350: Two (2) coats, 2 mils DFT per coat.
 - c. Total minimum system finish coating thickness shall be 5.5 mils DFT.
4. Class 6 Coating System (Surfaces identified as P-2 and P-3)

- a. Prime Coat: Epoxy Polyamide or Amine-Cure thinned up to 12-percent by volume with Carboline Thinner #33. One (1) coat 1 to 2 mils DFT per coat.
- b. Finish Coats: Epoxy Polyamide or Amine-Cure (Glossy). Carboline 890: Two (2) coats DFT, each 8 to 6 mils thick for a minimum total thickness of 14 mils DFT.

G. Class 7 Exposures - Metals, Immersion, Non-Potable

- 1. Class 7 exposures consist of exterior metal surfaces that are submerged in wastewater or exposed to splashing, mists and gases off wastewater treatment processes. Metals to be coated would include ferrous and non-ferrous surfaces that are not already finish coated or hot dip galvanized. The following would be included.
 - a. Exterior surfaces of pumps, equipment, and appurtenances located below operating decks for treatment units subject to contact with wastewater, liquid, or gases.
 - b. Piping, valves, and fittings subject to contact with wastewater liquid, gases or exposed to groundwater or submerged conditions including piping, fittings, and valves located in pumping station wetwells, valve vaults, and meter vaults.
 - c. Miscellaneous ferrous and non-ferrous steel plates, shapes, hardware, etc. subject to contact with wastewater liquid or gases.
 - d. Pumping station wetwell and valve vault access hatch covers and frames (interior surfaces).
- 2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition the following:
 - a. Bare metals or areas that were shop primed that have been damaged, shall be abrasive blast cleaned to SSPC-SP5, white metal blast cleaning standards.
 - b. Shop primed items, stored on-site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to SSPC-SP5, white metal blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.

- c. Non-ferrous metals shall be degreased and cleaned in compliance with SSPC-SP1 for solvent cleaning.
3. Class 7 Coating System
- a. Prime Coat for Ferrous Metals: Two-part epoxy polyamide primer. Carboline D888 Primer: One (1) coat, 4 mils DFT per coat.
 - b. Prime Coat for Non-Ferrous Metals: Zinc chromate wash primer. Carboline/Kop Coat 40 Passivator: One (1) coat, 0.5 mils DFT per coat.
 - c. Finish Coats: Polyamide cured coal tar epoxy. Kop Coat Bitumastic No. 300-M: Three (3) coats, 10 mils DFT per coat. Finish coats shall alternate colors as black - red - black.
 - d. Total minimum system finish coating thickness shall be 34 mils DFT for ferrous metals and 30.5 mils DFT for non-ferrous metals.

**NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS,
AS STATED BY THE COATING MANUFACTURER,
SHALL NOT BE EXCEEDED.**

H. Class 8 Exposures - Metals, Non-Immersion, Interior/Exterior

- 1. Class 8 exposures consist of interior and exterior metal surfaces that do not come in direct contact with wastewater or corrosive atmospheres and shall include the following:
 - a. Pumps, motors, equipment, and appurtenances.
 - b. Above ground piping, fittings, valves, and metal electrical conduit.
 - c. Miscellaneous steel plates, shapes, hardware, etc.
 - d. Roof-mounted equipment, hatches, ductwork, ventilation fans, etc.
 - e. Galvanized steel surfaces.
 - f. The lime silo exterior and appurtenances.
 - g. Other surfaces obviously requiring field coating or as specified to be field coated in Division 11 or in Section 09905: Piping and Equipment Identification Systems.
- 2. Surface Preparation: As specified in Paragraph 3.02 herein and in addition, the following:

- a. All bare metals or areas that were shop primed that have been damaged shall be abrasive blast cleaned to SSPC-SP6, commercial blast cleaning standards.
 - b. Shop primed items, stored on site for a prolonged period prior to coating, shall be prepared for coating following the coating manufacturer's recommendations prior to applying touch-up and subsequent coats. Surface preparation may include brush-off abrasive blasting or spot blasting to SSPC-SP6, commercial blast cleaning standards, for areas where the primer has been damaged and bare metal is showing.
 - c. Non-ferrous metals shall be degreased and cleaned in compliance with SSPC-SP1 for solvent cleaning.
3. Class 8 Coating System
- a. Prime Coat for Ferrous Metals: Two-part epoxy polyamide primer. Carboline D888 Primer: One (1) coat, 4 mils DFT per coat.
 - b. Prime Coat for Non-Ferrous Metals: Zinc chromate wash primer. Carboline/Kop Coat 40 Passivator: One (1) coat, 0.5 mils DFT per coat.
 - c. Intermediate Coat: Two component cross-linked epoxy. Carboline 890: One (1) coat, 8 mils DFT per coat.
 - d. Finish Coats: Single component, water-borne acrylic topcoat. Carboline 3359: Two (2) coats, 2 mils DFT per coat.
 - e. Total minimum system finish coating thickness shall be 16 mils DFT for ferrous metals and 12.5 mils DFT for non-ferrous metals.

NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS, AS STATED BY THE COATING MANUFACTURER, SHALL NOT BE EXCEEDED.

I. Class 9 Exposures - Plastic Piping, Valves, Fittings, and Conduit

- 1. Class 9 exposures consist of PVC or fiberglass piping or electrical systems requiring color coding, and for protection of exposed, exterior plastic components from the elements, and shall include the following:
 - a. PVC and fiberglass piping, fittings, valves, and electrical conduits requiring color coding in accordance with Section 09905: Piping and Equipment Identification System.

- b. Exposed exterior plastic piping, valve, and fitting components subject to UV degradation and weathering by the elements.
- 2. Surface Preparation: As specified in Paragraph 3.02 herein, including cleaning and washing with detergent to remove all dirt and foreign material, and light surface abrasion using medium grade sandpaper. Remove dust, dirt and debris with clean rags prior to coating.
- 3. Class 9 Coating System:
 - a. Finish Coats: Single component, water-borne acrylic topcoat.
Carboline 3359: Two (2) coats, 3 mils DFT per coat.
 - b. Total minimum system finish coating thickness shall be 6 mils DFT.
- J. Class 10 Exposures - Aluminum
 - 1. Class 10 exposures consist of aluminum surfaces embedded or in contact with concrete, mortar or plaster, or aluminum in contact with dissimilar metals, which may cause corrosion due to electrolysis, and shall include the following:
 - a. Aluminum surfaces in contact with concrete, mortar or plaster, such as slide gate frames, hatch cover frames, stair stringers, portions of grating and frames, floor plate and frames, etc.
 - b. Aluminum surfaces in contact with dissimilar metals, which may cause corrosion due to electrolysis.
 - 2. Surface Preparation: As specified in Paragraph 3.02 herein, including solvent cleaning in accordance with SSPC-SP1 standards for solvent cleaning.
 - 3. Class 10 Coating System:
 - a. Prime Coat: Zinc chromate wash primer.
Carboline/Kop Coat 40 Passivator: One (1) coat, 0.5 mils DFT per coat.
 - b. Finish Coats for Aluminum Exposed to View: Two-component, high build, modified aluminum epoxy mastic.
Carboline Carbomastic 90 Aluminum: Two (2) coats, 10 mils DFT per coat, color: Aluminum C901.
 - c. Finish Coat for Aluminum Not Exposed to View: Polyamide cured coal tar epoxy.

Kop Coat Bitumastic No. 300-M: One (1) coat, 20 mils DFT per coat, color: Black.

- d. Total minimum system finish coating thickness shall be 20.5 mils DFT.

K. Class 11 Exposures - High Temperature Steel to 1200°F

- 1. Class 11 exposures consist of carbon steel, hot dip galvanized steel and stainless steel surfaces exposed to high operating temperatures up to 1200°F, and shall include the following:
 - a. Exposed diesel engine exhaust piping and fittings, exhaust silencer and silencer supports that do not have an applied insulation system.
- 2. Surface Preparation: As specified in Paragraph 3.02 herein, including abrasive blast cleaning to SSPC-SP10 standards for near-white blast cleaning for ferrous surfaces or solvent cleaning to SSPC-SP1 standards for solvent cleaning for galvanized or non-ferrous surfaces.
- 3. Class 11 Coating System:
 - a. Prime Coat: Self curing, inorganic zinc primer consisting of a basic zinc silicate complex with a zinc filler.
Carboline Carbo Zinc 11: One (1) coat, 3.0 mils DFT per coat.
 - b. Finish Coats: Single packaged, modified silicone.
Carboline 4631: Two (2) coats, 1.5 mils DFT per coat.
 - c. Total minimum system finish coating thickness shall be 6 mils DFT.

PART 3 - EXECUTION

3.01 SHOP PAINTING

- A. Surface Preparation - All ferrous metal to be primed in the shop shall have all rust, dust and scale, as well as all other foreign substances, removed by sandblasting or pickling in accordance with SSPC-SP5 or SP8, respectively. Cleaned metal shall be primed or pretreated immediately after cleaning to prevent new rusting. Under no circumstances will cleaned metal be allowed to sit overnight before priming, or pretreatment and priming. All nonferrous metals shall be solvent cleaned prior to the application of primer. In addition, galvanized surfaces, which are to be top-coated, shall first be degreased then primed.
- B. Materials Preparation:

1. 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.
2. 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.

C. Applications:

1. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship. Coating systems shall be as specified herein.
2. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied.
3. All paint and coatings materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.
4. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.
5. 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 will produce an even film of uniform and proper thickness.
6. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
7. Equipment manufacturer or supplier shall provide touch-up paint for items with shop applied finish coats.
8. Where specified in the individual sections, primer coat(s) shall be applied in the shop by the equipment manufacturer. The shop coat(s) shall be as specified and shall be compatible with the field coat or coats.

- D. Certification: The Contractor shall obtain from the equipment manufacturer or supplier, prior to shipment of equipment, a written certification that surface

preparation, coating brand, material, DFT, and application method complied with this Section.

3.02 SURFACE PREPARATION

- A. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces that are to be coated.
- B. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items and surfaces not to be painted which are in contact with or nearby surfaces to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Refer to Paragraph 3.09B.
- C. Before commencing work, the painter must make certain that surfaces to be covered are in perfect condition and must obtain Engineer's approval to proceed. 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 will 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 will not fall onto wet, newly-painted surfaces.
- E. Ferrous Metal Surfaces:
 - 1. Remove any oil or grease from surfaces to be coated with clean rags soaked in toluol or other solvent recommended by coating manufacturer in accordance with SSPC specifications. Any chemical contamination shall be eliminated by means of neutralization or flushing or both prior to additional surface preparation. Clean rags shall be changed every 100-square feet.
 - 2. For immersion service, all sharp edges and welds shall be ground smooth to a rounder contour, all weld splatter shall be removed, and all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.
 - 3. For non-immersion service, all sharp edges and welds shall be ground, all weld splatter shall be removed, all pits and dents shall be filled, and all imperfections shall be corrected prior to sandblasting.
 - 4. For immersion service, all surfaces to be coated shall be sandblasted to white metal in accordance with Steel Structures Painting Council Specification SP-5 of National Association of Corrosion Engineers Specification NACE-2. A white metal blast is defined as removing all rust, scale, paint, etc., to a clean white metal that has a uniform gray-white appearance. No streaks or stains or rust or any other contaminants are allowed. The proper abrasive to obtain the specified surface profile (anchor

pattern) designated in the coating manufacturer's most recent printed application instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating.

5. For non-immersion service, or wherever specified in the coating manufacturer's most recent printed application instructions for other services, all surfaces to be coated shall be sandblasted to near white metal in accordance with Steel Structures Painting Council Specification SP-10 or National Association of Corrosion Engineers Specification NACE-2. A near white metal blast is defined as removing all rust, scale, paint, etc., except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of paint or coatings that may remain. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed Application Instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating. (This is 95 percent of any given surface area blasted to white metal.)
6. For non-immersion service surfaces to be coated shall be sandblasted where specified to a commercial sandblast in accordance with Steel Structures Painting Council Specification SP-6 or National Association of Corrosion Engineers Specification NACE-3. A commercial sandblast is defined as removing all rust, scale, paint, etc., except for slight shadows, streaks or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain; if the surface is pitted, slight residues of paint or rust, may be found in the bottom of pits. The proper abrasive to obtain the specified surface profile (anchor pattern) designated in the coating manufacturer's most recent printed Application Instructions shall be used. After sandblasting, dust and spent sand shall be removed from the surfaces by brushing or vacuum cleaning. The prime coat shall be applied as soon as possible after the blasting preparation is finished and always before the surface starts to rust. No sandblasted surface shall stand overnight before coating. (This is two-thirds of any given surface area blasted to white metal.)
7. Ferrous metal surfaces previously exposed to sulfides shall be sandblasted, flame-cleaned, and sandblasted again in accordance with the recommended surface preparation for the particular service in question.

8. Where blast cleaning is done in the field, only "virgin" sand, grit, or abrasive will be used.
9. Inaccessible areas, such as behind tank rafters or skip-welded lap joints, or in between back-to-back angle iron bracing, shall be coated before assembly to prevent corrosive action from taking place in these inaccessible areas. All surface voids shall be sealed-welded and back-to-back bracing and tank rafters either coated before assembly or eliminated from the design and construction. Sharp corners and edges shall be ground to a smooth contour and welds prepared as described above.

F. Concrete Surfaces:

1. All efflorescence, laitance, chalk, dust, dirt, oils, grease, concrete curing agents, form release agents, sealers, old coatings and other chemical contaminants shall be removed either by steam cleaning with detergent, by scrubbing with a hot trisodium phosphate solution consisting of 2 pounds of trisodium phosphate to each gallon of hot water (160°F), or by high pressure water blasting (3,000 psi or higher). Multiple cleaning operations may be required to remove all contaminants. Repeat the cleaning operation until the contamination is removed and flush the area with clean water to remove residual cleaning solution. Allow to dry thoroughly before coating.
2. All concrete surfaces to be coated shall be clean and dry. "Dry" is defined for new concrete as free of moisture and fully cured, which is a minimum of 30 days at 75°F and 50 percent Relative Humidity or some equivalent cure time at other conditions (7 days minimum for stucco). Moisture content of concrete shall be determined by using both of the following methods.
 - a. The presence of moisture shall be checked by taping a 1-foot square piece of 20 mil thick minimum plastic film on the surface. Pieces of test plastic film should be placed at various locations that are likely to be slow drying out, such as below grade, low spots in floors, inside corners and lower wall areas. The plastic film should be carefully sealed with tape to prevent the escape of any moisture or vapor that would be trapped behind the film. The film should be left in place over night or longer to allow sufficient time for moisture migration. After 16-hours minimum, remove and examine the backside for moisture condensation and inspect the concrete surface for darkened areas. The source of the moisture, if present, shall be located, and the cause corrected prior to coating.
 - b. The presence of moisture shall also be determined with a moisture detection device such as a Delmhorst Model DLM2E. Moisture determined by this method shall be less than 14 percent moisture content before coating operations shall be allowed to proceed.

3. Old paint and unremoved tar stains shall be solvent cleaned with naphtha, trichloroethylene, or perchloroethylene. Proper safety precautions shall be observed if this step is necessary. The surface shall be flushed with fresh water and dried.
4. Do not use form oils incompatible with coating, concrete curing agents, or concrete hardeners on concrete surfaces to be coated.
5. Concrete and/or cinder block walls to receive a coating shall be air-blasted with 100 psi clean, dry, oil-free air to remove dust, etc., and wire brushed to remove all loose and/or weak mortar. See requirements for sumps, tanks and other water-bearing structures below.
6. Concrete floors shall be thoroughly swept clean and then acid etched. Acid etching consists of first dampening the entire surface with clean water - avoid and excess of water that will form puddles. Acid etch the damp floor with a 10 to 15 percent solution of hydrochloric (muriatic) or phosphoric acid. Allow the acid to stand on the floor until the bubbling stops. For best results, while the acid is bubbling, scrub the floor with a stiff-bristled brush. Do not allow the "spent" acid to dry on the floor. Rinse the surface thoroughly with fresh water. If the surface does not appear as rough as medium grit sandpaper, repeat the above steps. Neutralize the surface with a 5 percent solution of soda ash, tri-sodium phosphate, or ammonium hydroxide in clean water. Let the solution stand for 10-minutes on the surface. Rinse thoroughly with water. The surface must be slightly alkaline (pH of 9.0) prior to coating.
7. The floors or concrete sumps, tanks or other water-bearing structures should be acid etched as described above or they may be sandblasted. The walls of concrete sumps and tanks must be sandblasted. Roughen the surface to a texture equivalent to that of medium grit sandpaper. Use compressed air blast nozzle with oil-free air. The abrasive used should be dry silica sand with the maximum particle size that will pass through a 16-mesh screen and minimum particle size retained on a 30-mesh screen. After blast cleaning is completed, sand, dust and loose particles should be removed from the surface by vacuuming or blowing off with high-pressure oil-free air. Examine the surface for texture and uniformity, as well as the removal of dust, efflorescence and laitance. Patch voids and cracks that will cause discontinuities in the coating or unsightly appearance using a patching compound compatible with the coating system.

- G. Wood Surfaces: Wood should be clean and dry. Remove surface deposits of sap or pitch by scraping and wiping clean with rags dampened with mineral spirits or VM & P Naphtha. Seal knots and pitch pockets with shellac reduced with equal parts of shellac thinner (denatured alcohol) before sandpaper and finishing with fine grit and remove sanding dust. After the prime coat is dry, fill cracks and holes with putty or spackling compound. When filler is hard, sand flush with the surface

using fine grit sandpaper. Sand lightly between coats with fine grit, open-coated sandpaper

H. Galvanized Steel and Non-Ferrous Metal:

1. Galvanized steel and aluminum will only be coated when so specified.
2. Surfaces shall be clean and dry. Remove dust and dirt by blowing off the surface with high-pressure air or wiping clean with dry rags. Oil, grease and protective mill coatings should be removed by solvent cleaning in accordance with SSPC-SPL.
3. White rust should be removed from galvanized steel or aluminum by hand or power brushing. Care should be taken not to damage or remove the galvanizing. Rust should be removed from old galvanized steel by Hand or Power Tool Cleaning in accordance with SSPC-SP2 or SP3.
4. Other surface preparation as outlined in the coating manufacturer's latest written Application Instructions shall be observed for more demanding exposures.

I. Stainless Steel:

1. Stainless steel will only be coated when so specified, or when it is adjacent to areas to be coated such as piping supports, anchor bolts or flange bolts.
2. Stainless steel requires only solvent cleaning prior to coating using any one of the methods in SSPC-SP1. Only solvents and cleaning solutions containing less than 200 ppm of halogens should be used to prevent stress corrosion cracking.
3. Stainless steel may be whip-blasted to provide a surface profile to increase the mechanical bond of the coating system. The height of the profile and the texture required should be defined for the operator and as a standard for the acceptance of the work. Pictorial standards for the surface cleanliness of carbon steel are not applicable to stainless steel, since there are no corrosion products or mill scale to remove from the surface.
4. Abrasive blast cleaning procedures outlined by Steel Structures Painting Council for carbon steel may also be used for stainless steel. Only very hard silica sand or other abrasive media should be used for a fast cutting action and to obtain a sharp angular profile.

J. Gypsum Drywall:

1. Sand joint compound with fine grit, open-coated sandpaper to provide a smooth flat surface. Avoid heavy sanding of the adjacent wall board

surfaces, which will raise the nap of the paper covering. Remove dust from the surface by wiping with clean rags or other means. If additional joint finishing is required to provide a smooth surface, the same joint compound of a ready-mixed spackling compound should be used. Putty, patching pencils, caulking, or masking tape should not be applied to dry wall surfaces to be painted.

2. Lightly scuff-sand tape joints after priming to remove raised paper nap. Take care not to sand through the prime coat and remove dust by wiping with clean rags.

K. PVC or Other Plastic Piping or Ductwork:

1. Solvent clean.
2. If recommended by manufacturer, lightly abrade surface with medium grade sandpaper. Remove dust by wiping with clean rags.

3.03 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. Except where otherwise specified, thinning shall be done only if necessary for the workability of the coating material and then, only in accordance with the coating manufacturer's most recent printed Application instructions. Use only thinner provided by coating manufacturer. 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.

3.04 APPLICATION

- A. Paint all exposed surfaces in rooms scheduled for painting whether or not colors are designated in schedules, except where the natural finish of material is obviously intended and specifically noted as a surface not be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas. If color of finish is not designated, the Engineer will select these from standard colors available for the materials systems as specified.
- B. Color Selection
 1. Colors for Multi-coat Systems: Each coat shall be applied in a different color or shade from the preceding coat to aid in determining the uniformity

and coverage of the coating. The finish coat color shall be selected by the Owner or Engineer. When a white finish coat is specified, the last two (2) coats shall be white.

2. Color Coding Piping: All exposed piping shall be identified as specified in Section 09905: Piping and Equipment Identification System. Pipe identification system shall include color coding or banding, legends, and arrows.
 3. Color Coding Conduit: All exposed electrical conduit with conductors over 120 volts shall be color banded as specified in Division 16: Electrical and Section 09905: Piping and Equipment Identification System (color code, if provided, takes precedence).
 4. All interior walls of buildings shall have a Wainscot (for each floor, the lower section of wall coated a contrasting color) from the floor to a level 56 inches above the highest elevation for that floor. Color of wainscot shall be selected by Owner.
- C. All painting shall be done by skilled and experienced craftsmen and shall be of highest quality workmanship.
- D. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. All equipment shall be maintained in good working order and shall be comparable to that described in the coating manufacturer's most recent Application Instructions. It shall be thoroughly cleaned and inspected daily. Worn spray nozzles, tips, etc., shall be replaced regularly. Effective oil and water separators shall be used and serviced on all air lines.
- E. All paints and coating materials shall be stored under cover and at a temperature within 10°F of the anticipated application temperature and at least 5°F above the dew point.
- F. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color, and appearance.
- G. 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 will produce an even film of uniform and proper thickness. Allow each coat to dry thoroughly before applying the next coat; follow manufacturer's recommendations taking into account temperature and relative humidity.
- H. All interior surfaces of structures shall be finish coated prior to installation of equipment, conduit, and other exposed items by Mechanical, Electrical, or Instrumentation.

1. Paint back sides of access panels and removable or hinged covers to match the exposed surfaces.
- I. Finish exterior doors on tops, bottoms, and side 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, which 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 two (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.

3.05 APPLICATION RESTRICTIONS

- A. Environmental Requirements:
 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
 - a. The conditions below shall be adhered to even if manufacturer's recommendations are less stringent. If manufacturer's recommendations are more stringent, they shall apply.
 - b. No coatings shall be applied when the air, surface, and material temperature is below 55°F or above 95°F for 24 hours prior to and 24 hours after coating application. Surface temperature shall be at least 5°F above the dew point for 24 hours prior to and 24 hours after coating application. The dewpoint shall be determined by use of a sling psychrometer in conjunction with U.S. Weather Bureau psychrometric tables. Do not apply coatings when the relative humidity exceeds 85 percent or to damp or wet surfaces, unless otherwise permitted by the coating manufacturer's printed instructions. No painting shall be done when the surfaces may become damaged by rain, fog or condensation or when it is

anticipated that these conditions will prevail during the drying period, unless suitable enclosures to protect the surface are used. Where heat is necessary, it shall be supplied by the painting applicator and shall be of such type that it will maintain an air and coated surface temperature of 55°F minimum prior to and after the coating application as described above, and 90°F minimum during the cure stage if hot air forced curing is recommended by the coating manufacturer for special coatings. Further, this heater shall be of such type as not to contaminate the surface area to be or being coated with combustion products. The Contractor shall supply utilities to run electric or gas heaters. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.

2. Do not apply finish in areas where dust is being or will be generated during application through full cure.
 3. All exterior painting shall be done only in dry weather.
 4. Spray application shall occur only when wind velocities, including gusts, are less than 10 miles per hour. All materials, equipment, etc. in the vicinity of spray application shall be protected from overspray.
- B. Application of materials shall be done only on properly prepared surfaces as herein specified. Between any two coats of material, unless specifically cover in the coating manufacturer's most recent printed application instructions, if more than one (1) week passes between subsequent coats, the coating manufacturer will be contacted for his recommended preparation of the surface prior to application of the next coat. This preparation might include brush-off blasting, steam cleaning, or solvent wiping (with an indicated solvent) and shall be specified in writing by the material supplier and followed by the applicator. Any surface coating damaged by moisture or rain shall be removed and redone as directed by the Owner or Engineer.
- C. In no case shall paint be applied to surfaces which show a moisture content greater than 14 percent. The presence of moisture shall be determined prior to coating by testing with a moisture detection device such as a Delmhorst Model DLM2E.

3.06 MINIMUM COATING THICKNESS

- A. Coating thickness shall meet or exceed the specified minimum dry film thickness (DFT) in all areas. The average coating thickness as determined by multiple representative DFT measurements shall meet or exceed the mid-point of DFT range. If below this DFT value, the surface shall be recoated with at least the minimum DFT until the total DFT meets or exceeds the mid-point DFT.

- B. Coverage rates are theoretical as calculated by the coating manufacturer and are, therefore, the maximum allowable.
- C. Apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
- D. On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.
- E. 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.

3.07 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 will 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.

3.08 FIELD QUALITY CONTROL

- A. The Contractor shall request acceptance of each coat by the Owner's representative before applying the next coat; and the Contractor shall provide the necessary properly calibrated gauges. All nonferrous 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 or K-D Bird Dog Holiday Detector. All defects shall be corrected to the satisfaction of the Owner.

3.09 PROTECTION

- A. All other surfaces shall be protected while painting.
- 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 area where painting is being done to adequately protect flooring and other work from all damage.

3.10 CLEANING

- A. The Contractor shall perform the work under this Section while keeping the premises free from accumulation of dust, debris, and rubbish and shall remove all scaffolding, paint cloths, paint, empty paint containers, and brushes from buildings and the project site when completed.
- B. Cleaning: All paint brushed, splattered, spilled, or splashed on any surface not specified to be painted shall be removed.
- C. The Contractor shall insure that all glass throughout that portion of the facility in which he worked is cleaned of dirt and paint before he leaves the job site. Further, the Contractor shall insure that all glass in this area is thoroughly washed and polished.
- D. Upon completion of the project, the job site shall be left neat and clean.

3.11 EXTRA STOCK

- A. Paint To Be Supplied To Owner: Upon completion of painting work, the Owner shall be furnished at no additional cost, unopened containers providing a minimum of one (1) gallon of each type and color of finish paint for touching up. Multi-component coatings shall have each component supplied in separate containers boxed together. Paint container labels shall be complete with manufacturer's name, generic type, number, color, and location where used.

END OF SECTION

SECTION 09905

PIPING, VALVE, AND EQUIPMENT IDENTIFICATION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.
- B. Related Work Described Elsewhere:
 - 1. Painting: Section 09900

1.02 QUALITY ASSURANCE

- A. Standards: ANSI Standard A13.1, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

- A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data.
- B. Schedules:
 - 1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.
 - 2. Provide a complete list of materials to be furnished and surfaces on which they will be used.
- C. Samples:
 - 1. Provide a sample of each type valve tag supplied.
 - 2. Provide a sample of each type of identification tape supplied.
 - 3. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDING

- A. Delivery Of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.
- B. Storage Of Materials:
 - 1. Store only acceptable project materials on project site.
 - 2. Store in suitable location.
 - 3. Restrict storage to paint materials and related equipment.
 - 4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.
 - 2. Do not apply finish in areas where dust is being generated.
- B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials for painting shall conform to requirements of Section 09900: Painting.
- B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.
- C. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company.
 - 1. Markers shall be of wording and color as shown in Table 09905.
 - 2. Lettering shall be:
 - a. 2 1/4-inches high for pipes 3-inches diameter and larger.
 - b. 1 1/8-inches high for pipes less than 3-inches diameter.

3. Flow arrows shall be:
 - a. 2 1/4-inches by 6-inches for pipes 3-inches diameter and larger.
 - b. 1 1/8-inches by 3-inches for pipes less than 3-inches diameter.

D. Buried piping shall be identified by identification tape installed over the centerline of the pipelines.

1. Identification Tape for Steel or Iron Pipe: Identification tape shall be manufactured of inert polyethylene film so as to be highly resistant to alkalies, acids, or other destructive agents found in soil, and shall have a minimum thickness of 4 mils. Tape width shall be 6-inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2-feet for entire length of tape. Tape shall be Terra Tape Standard 250, or approved equal.
2. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalies, acids, and other destructive agents found in soil. Tape width shall be 3-inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2-feet for entire length of tape. Tape shall be TerraTape Sentry Line 1350, or approved equal.
3. Tape background colors and imprints shall be as follows:

<u>Imprint</u>	<u>Background Color</u>
"Caution Sewer Line Buried Below"	Green
"Caution Electrical Line Buried Below"	Red
"Caution Water Line Buried Below"	Blue
"Caution Telephone Line Buried Below"	Orange
"Caution Reuse Line Buried Below"	Purple

4. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; Allen Systems, Inc., Wheaton, IL; or approved equal.

- E. Aboveground Valve Identifications: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.
 - 1. Tag Types: Tags for valves on pipe shall be brass or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipeline on which installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.
 - 2. Coding: In addition to the color-coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in Table 09905, or by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.
- F. Buried valves shall have valve boxes protected by a concrete pad. The concrete pad for the valve box cover shall have a 3-inch diameter, bronze disc embedded in the surface as shown on the Drawings. The bronze disc shall have the following information neatly stamped on it:
 - 1. Valve Service - See Table 09905 for abbreviations;
 - 2. Valve Identification No.;
 - 3. Size of valve, inches;
 - 4. Type of valve:
 - a. GV - Gate Valve.
 - b. BFV - Butterfly Valve.
 - c. PV - Plug Valve.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

- A. Piping color codes, and code labels for pipe identification shall conform to Table 09905.

B. General Notes and Guidelines:

1. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.
2. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.
3. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.
4. All safety equipment shall be painted in accordance with OSHA standards.
5. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.
6. All pipe hangers and pipe support floor standards shall be painted, unless specified otherwise due to material of construction.

C. All hangers and pipe support floor and accessories stands shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangars or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09900.

D. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

E. All insulated surfaces, unless otherwise specified, shall be given one coat of glue sizing, one prime coat and one finish coat.

F. System code lettering and arrows shall conform to the requirements of ANSI A 13.1 marked on piping as follows:

1. Legends shall be of the following color for the respective pipe color:

<u>Key to Classification of Predominant Colors For Piping</u>		<u>Color of Letters, if not otherwise specified</u>
(F) Fire Protection:	Red	White
(D) Dangerous:	Yellow	Black
	Orange	Black
(S) Safe:	Green	Black
	White	Black
	Black	White
	Light Grey	Black
	Dark Grey	White
	Aluminum	Black
(P) Protective:	Blue	White

2. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10-feet and with at least two labels in each room. Otherwise, markers shall be placed no more than 20-feet apart with at least one marker on every straight run and additional markers at turns and where pipe passes through walls.
3. An arrow indicating direction of flow shall be placed adjacent to each marker.

3.02 FABRICATED EQUIPMENT

- A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09900 - Painting.
- B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage from weather or any other cause.
- C. Where specified in other sections of these specifications for mechanical equipment, the Contractor shall apply field coat or coats of paint in accordance with Section 09900. If shop finish coat is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.
- D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any

equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.03 INSTALLATION OF IDENTIFICATION TAPE

- A. Identification tape shall be installed for all buried wastewater lines in accordance with the manufacturer's installation instructions and as specified herein.
- B. Identification tape for piping shall be installed at two (2) locations:
 - 1. One (1) foot below finished grade along centerline of pipe, and;
 - 2. Directly on top of the pipe.

3.04 BURIED VALVES

- A. In paved or concrete areas, tops of valve box covers shall be set flush with pavement or concrete top. In concrete areas, valve boxes shall be embedded. Following paving operations, a 24-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 24-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,000 psi compressive strength.
- B. In unpaved areas, tops of valve box covers shall be set 0.20-foot above finished grade. After the top of the box is set to the proper elevation, a 24-inch square by 6-inch thick concrete pad shall be poured around the box cover. Concrete for the pad shall be 3,000 psi compressive strength.
- C. The bronze, valve identification disc shall be embedded in the concrete pad.

TABLE 09905

COLOR CODES AND ABBREVIATIONS

Service	Mark	Conduit, Pipe, and Valve Color Code	Letter and Flow Arrow Color
Compressed Air	Air Fix	Light Grey	Black
Alum Solution	AS	Orange	Black
Chlorine Solution	CS	Yellow	Black
Gravity Drain	DR	Brown	Black
Filtered Effluent	FE	Dark Green	Black
Force Main	FM	Brown	Black
Lime Solution	LS	Light Green	Black
Mixed Liquor	ML	Brown	Black
Non-potable Water	NPW	Purple	Black
Polymer Solution	PS	Orange w/green band	Black
Potable Water	PW/CW	Blue	Black
Return Activated Sludge	RAS	Brown	Black
Reuse Water	REUSE	Purple	Black
Raw Wastewater	RWW	Brown	Black
Scum	SCUM	Brown	Black
Secondary Effluent	SEFF	Dark Green	Black
Substandard Effluent	SSE	Brown	Black
Waste Activated Sludge	WAS	Brown	Black
Diesel Fuel	FR & FS	OSHA Red	White
Helium	He	Red w/yellow band	White
Hydrogen	H ₂	Red w/black band	White
Nitrogen	N ₂	Yellow w/red band	White
Argon	AR	Yellow w/black band	White
Nitrous Oxide	N ₂ O	Yellow w/orange band	White
Acetylene	C ₂ H ₂	Orange w/yellow band	White
Argon-Methane Mix	AR/ CH ₂	Orange w/black band	White
Vacuum Line	VAC	Light Olive Green	White
Gas Line	G	Orange w/red band	White

END OF SECTION

10100-Buy American Provisions

Materials used in this project will be required to meet the provisions outlined in this section.

b. American Iron, Steel, and Manufactured Goods

Section 1605 of the ARRA requires that none of the appropriated funds may be used for the construction, alteration, maintenance, or repair of a public building or public work unless all of the iron, steel, and manufactured goods used in the project is produced in the United States unless (a) a waiver is provided to the recipient by EPA or (b) compliance would be inconsistent with United States obligations under international agreements. In order to receive a waiver, the State must send a written request to the Administrator. A decision will be made based on the following criteria:

1. The requirement is inconsistent with the public interest for purposes of the project for which a waiver has been requested,
2. Iron, steel, and necessary manufactured goods are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality, or
3. Inclusion of iron, steel, and manufactured goods produced in the United States will increase the overall cost of the project by more than 25 percent.

If a waiver is granted by the Administrator, EPA will publish such waiver, with a sufficient explanation, in the Federal Register. EPA will provide additional guidance on this provision as it becomes available.

10101 – Davis-Bacon Act Requirements

All Contractors and sub-contractors will be required to follow the provisions outlined in the Davis-Bacon Act.

Prevailing Wages

Section 1606 of the ARRA contains the following language:

“Notwithstanding any other provision of law and in a manner consistent with other provisions in this Act, all laborers and mechanics employed by contractors and sub contractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to this Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards specified in this section, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C.App.) and section 3145 of title 40, United States Code.”

The purpose of this language is to apply Davis-Bacon Act wage rules to all assistance agreements made in whole or in part with funds appropriated under the ARRA. The Department of Labor provides all pertinent information related to compliance with labor standards, including prevailing wage rates and instructions for reporting.

10102-Minority and Women's Owned Business Enterprises

Owner will require Contractor to verify that all solicitation for sub-contractors has complied with the following:

- 1) Included qualified minority and women's businesses on solicitation lists.
- 2) Solicited minority and women's businesses whenever they are potential sources.
- 3) Divided total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by minority and women's businesses.
- 4) Where feasible, established delivery schedules which will encourage participation by minority and women's businesses.

Used the services and assistance of the U.S. Department of Commerce's Minority Business Development Agency (MBDA) and the U.S. Small Business Administration to identify MBEs/WBEs

SECTION 11200
EXHAUST FANS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the complete installation of two (2) industrial wall mounted exhaust fans in the chlorination building and ready for operation as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere: Other sections directly referenced in this section include the following:
 - 1. Section 13125: Metal Building Systems
 - 2. Section 08900: Louvers and Vents
 - 3. Division 16 Electrical.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Exhaust fans must meet performance criteria described in 1.03.

1.03 PERFORMANCE REQUIREMENTS

- A. Individual units shall include cabinet fan and motor with exhaust wall shutters and rated for continuous duty to deliver 3,000 SCFM of air.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1.04 SUBMITTALS

- A. For each product used please submit the following information:
 - 1. Manufactures warranty and specification sheet.

2. Header/Lintel material

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before procurement and installation.

PART 2 - PRODUCTS

2.01 EXHAUST FANS

- A. Each of the fans shall include the following components:
1. 115 VAC, 60 HZ, Direct drive one speed electric motor rated for continuous operation.
 2. Fan blades designed to generate the minimum air flow and maintain their design characteristics and integrity at temperatures up to 122° Fahrenheit (50° C).
 3. The wall mounting brackets shall be galvanized steel of sufficient gauge.
 4. On-off and speed control switch shall be UL certified.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site. Insure the plan opening in the wall so that the block will be clear of the shutter frame.
- B. Plan for an angle iron header

3.03 INSTALLATION

- A. Use “C” channel to construct the framing and header for the fan.
- B. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather-tight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.04 ADJUSTING AND CLEANING

- A. Test operation of fan unit and exhaust shutters and adjust as needed to produce fully functioning units that comply with manufactures parameters.

END OF SECTION

SECTION 11210

SOLAR POWERED AIR MOVEMENT ENHANCEMENT SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the complete installation of a solar powered air movement enhancement system in the sludge drying beds consisting of solar panels, two (2) 12-volt automotive batteries, two (2) inverters, and two (2) ¼ HP exhaust fans. The system shall be ready for operation as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere: Other sections directly referenced in this section include the following:
 - 1. Division 16 Electrical.

1.02 PERFORMANCE REQUIREMENTS

- A. Solar panels shall be rated for minimum of 200 watts at 16 VDC at the full capacity.
- B. 12-Volt batteries shall be capable of sustaining 50 amps of continuous current.
- C. Voltage inverter shall be capable of converting 12 VDC to a sustained 120 VAC power with a minimum efficiency of 70%.
- D. Exhaust fan shall be ¼ HP, belt-drive, and be of the outdoor type.

1.03 SUBMITTALS

- A. For each product submit manufactures' specifications and warranty.

1.04 PROJECT CONDITIONS

- A. Field Measurements: Verify actual material and dimensions of the drying bed overhead shed by field measurements and observation to determine the mounting mechanism.

PART 2 - PRODUCTS

2.01 SOLAR PANELS

- A. Solar panels will be Kyocera® Model KC200GT or equivalent. Each individual solar panel shall meet the following specifications:
 - 1. Maximum power voltage of 16 volts.
 - 2. Minimum power output 200 watts at 16 volts.

2.02 BATTERY

- A. The battery to operate the solar powered air movement enhancement system shall meet the following criteria:
 - 1. Shall be of a deep-cycle, 12V, rechargeable type.
 - 2. Shall be rated to provide a minimum of 50 amps of continuous power.

2.03 INVERTER

- A. The inverter shall serve to change direct current (DC) from the battery to alternating current (AC). The inverter shall meet the following criteria:
 - 1. Shall be of the surge compliant stand-alone type.
 - 2. Input power: 12 VDC
 - 3. Output power: 120 VAC
 - 4. Shall be sized to provide a minimum of 200 watts at 120VAC.
 - 5. The inverter shall have minimum of 70% efficiency.

2.04 EXHAUST FANS

- A. Each of the fans shall include the following components:
 - 1. 115 VAC, 60 HZ, ¼ HP, belt-drive, one speed electric motor rated for continuous operation.
 - 2. Fan blades shall be nominal 3 feet long and designed to maintain their design characteristics and integrity at temperatures up to 122° Fahrenheit (50° C).
 - 3. The mounting brackets shall be field determined so the fan can be secured on the overhead shed. The brackets shall be galvanized steel of sufficient gauge.

4. The fan shall be equipped with an on-off switch. The fan and the switch shall be UL certified.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify actual material and dimensions of the drying bed overhead shed in the field to determine the appropriate mounting mechanism for the solar panels and the fans.
- B. Follow the manufacturers' installation manuals, guidance, or other requirements.
- C. Proceed with installation only after consulting with the manufacturers.

3.02 INSTALLATION

- A. Install the solar panels and fans as recommended by the manufacturers.
- B. The power inverters shall be installed under the shed and be protected from open drip.
- C. The batteries shall be secured on a leveled, stable surface protected from vehicular traffic, the reach of equipment, or hand tool movement.
- D. Wiring shall be completed for outdoor applications.

END OF SECTION

SECTION 11219

NON-POTABLE PLANT WATER SYSTEM

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install, place in operation, and field test non-potable plant water pumps, controls, motors and pre-charged hydropneumatic tanks as specified herein.
- B. These Specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment application. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete pumping units as shown on the Drawings and specified herein, whether specifically mentioned in these Specifications or not.
- C. For all units there shall be furnished and installed all necessary and desirable accessory equipment and appurtenances, whether specifically mentioned in these Specifications or not, as required for an installation incorporating the highest standards for this type of service.

1.02 RELATED WORK

- A. Concrete work is included in Division 3.
- B. Painting, except as specified herein, is included in Division 9.
- C. Instrumentation and Controls: Section 13615
- D. Mechanical piping, valves, pipe hangers and supports are included in the respective Sections of Division 15.
- E. Electrical work, except as hereinafter specified, is included in Division 16.
- F. Concrete bases for pumps and pump motors and installation of anchor bolts are included in Division 3, but anchor bolts shall be furnished under this Section.

1.03 DESCRIPTION OF SYSTEMS

- A. Two (2) pumping units and two (2) hydropneumatic tanks are required for this Contract. The pumping units and hydropneumatic tanks shall be located and arranged as shown on the Drawings.
- B. The plant water pumps will take suction from a 2-inch suction header connected to the chlorine contact chamber as shown on the Drawings.

1.04 QUALIFICATIONS

- A. To assure unity of responsibility, the motor shall be furnished and coordinated by the pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire pumping system including pump, motor, hydropneumatic tanks and electrical controls as specified. The pumps and hydropneumatic tanks shall be as shown on the Drawings.
- B. The pumps covered by these Specifications are intended to be standard pumping equipment of proven ability as manufactured by a reputable manufacturer having long experience in the production of such pumps. The pumps furnished shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed. Pumps shall be manufactured in accordance with the Hydraulic Institute Standards.
- C. All equipment furnished under this Specification shall be new and unused and shall be the standard product of a manufacturer having a successful record of manufacturing and servicing the equipment and systems specified herein a minimum of five (5) years.

1.05 SUBMITTALS

- A. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with the provisions of the General Conditions and Section 01340 of these Specifications. Submittals shall include the following:
 - 1. Certified shop and erection drawings showing all important details of construction, dimensions and anchor bolt locations.
 - 2. Descriptive literature, bulletins, and/or catalogs of the equipment.
 - 3. Data on the characteristics and performance of the pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, efficiency, NPSHR, and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at as large a scale as is practical, laminated in plastic. Five copies are to be submitted. Curves shall be

plotted from no flow at shut off head to pump capacity at minimum specified total head. Catalog sheets showing a family of curves will not be acceptable.

4. A complete total bill of materials of all equipment, including the weights of equipment, furnished.
 5. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Paragraph 1.07, with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.
 6. Complete motor data.
 7. Copies of all factory test results, as specified in PART 2 - PRODUCTS of this Section of the Specifications.
 8. Data on the hydropneumatic tanks, including total volume and drawdown volume at the specified operating pressure range.
- B. Upon receipt and review of submitted material, provide the required number of certified prints and one reproducible tracing of all Drawings as specified in Section 01340.

1.06 OPERATING INSTRUCTIONS

- A. Operating and maintenance manuals shall be furnished. The manuals shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operation and maintenance personnel unfamiliar with such equipment. The number and special requirements shall be as specified in Section 01730.
- B. A factory representative of all major component manufacturers, who has complete knowledge of proper operation and maintenance, shall be provided for one (1) day to instruct representatives of the Owner and the Engineer on proper operation and maintenance. With the Owner's permission, this work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.07 TOOLS AND SPARE PARTS

- A. One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.
- B. The manufacturers of the equipment specified herein shall furnish a complete set of recommended spare parts necessary for the first five (5) years of operation of the pumping system. Additional spare parts to be furnished where required, are listed in the respective paragraphs of PART 2 - PRODUCTS.
- C. Spare parts shall be properly bound and labeled for easy identification without opening the packaging, and suitably protected for long-term storage.

1.08 PRODUCT HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.
- B. All equipment and parts must be properly protected against any damage during a prolonged period at the site.
- C. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- D. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built and securely bolted thereto.
- E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- F. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
- G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.09 WARRANTY

- A. Provide equipment warranty as specified in Section 01740.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The pumping units required under this Section shall be complete including proper alignment and balancing of the individual units. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs and adjustment shall be provided.
- B. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and all other pertinent data shall be attached to each pump and motor.
- C. Each pumping unit and its driving equipment shall be designed and constructed to withstand the maximum turbine run-away speed of the unit due to backflow through the pump with the maximum TDH specified available at the pump discharge flange.

2.02 PUMPS

- A. The plant water pumps shall be horizontal, self-priming, close coupled, centrifuged pumps. The pumps shall have a capacity of 53 GPM when operating at a total head of 40-feet. The pump shall be as manufactured by Sta-Rite Industries, or approved equal.
- B. The pump shall be furnished with mechanical shaft seals. The suction and discharge connectors shall be NPT threaded integrally cast with the pump casing. The pump discharge shall be in the vertical position. The pump casing shall be cast of ASTM A48 Class 30 cast iron. A precision molded and dynamically balanced impeller shall be mounted on the stainless steel shaft.
- C. The pump shall be mounted on a steel base plate and directly coupled to a 2.5 HP, 3 Phase, 230/460 Volt. TEFC motor.
- D. Each pumping unit shall be equipped with a Mesh T-filter basket strainer in-line on the suction piping. Basket strainers shall be rated for 150 psi working pressures with molded heavy-duty PVC filter and clear polycarbonate filter insert cover. Filters shall be 2-inch, 60 mesh T-filters as manufactured by Vu-flow, or equal.
- E. Pressure switches shall be of the bourdon-type as manufactured by Mercoird Series DA, 0-150 psi, or equal. Three pressure switches are required: a) high pressure; b) low pressure; c) pump on/off. Pressure switches shall be provided in a NEMA 4x enclosure.
- F. Refer to Electrical and Instrumentation Drawings and Section 13615 for coordination with plant data collection system.

2.03 HYDROPNEUMATIC TANKS

- A. Two pre-charged, bladder-type hydropneumatic tanks shall be furnished under this contract. The tanks shall be Con-Aire controlled air/water system tanks, Model CA220 as manufactured by Sta-Rite Industries, Inc., or approved equal.
- B. The hydropneumatic tanks shall be equipped with a rugged, replaceable, seamless vinyl air/water separator. The separator shall be acid and alkali resistant, flexible and nonporous. The separator shall be easily removable should it require replacement.
- C. The tank shall be constructed of heavy gauge steel suitable for operating pressures to 75 psi. The tank shall be coated with a durable enamel finish. An air charge valve shall enable the pre-charge pressure to be increased or decreased. Each tank shall have a minimum useable drawdown volume of 22 gallons when operating between 40 and 62 psi, so that the total system will have a useable drawdown capacity of no less than 44 gallons.

1. CONTROL PANEL

- A. General: One (1) control panel shall be supplied for the non-potable water pump station, containing all the electrical and mechanical equipment necessary to provide for the operation of designated number of pumps specified herein and shown on the drawings. The panel shall be post mounted type and include the following:
 - 1. Three pressure switches
 - a. high pressure
 - b. low pressure (start 2nd pump)
 - c. pump on/off
 - 2. HOA for non-potable plant water pumps.
 - 3. On/off switch and starter for chlorine residual analyzer sample pump.
- B. Operation Requirements:
 - 1. The control panel shall consist of a main circuit breaker, motor circuit protectors, NEMA rated motor starters and overloads, phase monitor, alternator, and 15-ampere, 120-volt circuit breakers as required. A low and high pressure and pump shutoff shall be accomplished by pressure switches with all control components mounted in one common enclosure. Control

switches shall provide means to operate each pump manually or automatically. When operated in the automatic mode, the control assembly shall provide means to manually select the alternation on each pump.

2. Construction and Materials: The control panel shall be NEMA 4X of Type 316 stainless steel construction with welded double locking hasps oriented as shown on the Drawings.
3. Panel Exterior:
 - a. Panel shall have heavy-duty hasp and staple, stainless steel hinge and pins, ground stud, backplate as manufactured by Hoffman-type A4S or equal.
 - b. All exterior mounted accessories shall be constructed of corrosion-proof materials such as stainless steel or aluminum.
4. Panel Front Door:
 - a. The front door shall be mounted with a continuous hinge, and shall be furnished for protection against exposed wiring. Mounted on the front door will be pump run lights, hands-off automatic switches, main circuit breaker disconnecting means, a 20-ampere ground fault duplex receptacle, elapse time meters, motor resets, alternator manual/auto selection switch, duplex receptacle breaker.
 - b. A permanently affixed 11-inch by 17-inch (minimum), laminated panel wiring schematic and pump data sheet shall be installed on the interior of the enclosure door.
5. Control Circuits: The control circuit breakers shall operate on 115-volts.
6. Panel Components: The following power and control components shall be provided:
 - a. Circuit Breakers: All circuit breakers shall be heavy-duty ER molded case breakers as manufactured by Square D or equal.
 - b. Mechanical Disconnect: A mechanical NEMA 4X disconnect mechanism shall be interlocked with the interior main breaker to provide means of disconnecting power to all the pump motors.
 - c. The control panel shall include an adjustable time delay relay to prevent both NPW pumps from starting simultaneously. Relays shall be Paragon Electric Company, Series JS, or equal.

- d. Duplex Service Receptacle: A duplex service receptacle supplying 20-amps at 115-volts shall be provided on the panel door. The duplex receptacle shall be provided with ground fault protection.
 - e. Lightning Arrestor and Surge Capacitor: A lightning arrestor and surge capacitor shall be installed and wired to protect motors and control equipment from lightning-induced line surges and transient voltage surges.
 - f. Indicator Lights: Indicator lamps shall be mounted in NEMA 4X press-to-test modules, as manufactured by Allen-Bradley, or equal. Lamp modules shall be easily replaceable from the front of the control compartment door without removing lap module from its mounted position.
 - (1) Pump Run Lights: A 120-volt pump run light shall be connected in parallel with each motor starter and indicate when a particular pump is running.
 - (2) Provide high and low pressure alarm indicators.
 - g. All control wire shall be tinned copper 300V and identified at each end.
- 7. The panel supplier shall provide 6-inches of space between starters and 8-inches of space from bottom of panel to starter motor lead connections.
 - 8. Furnish Plant SCADA interface signals as indicated in Section 13600

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.
- B. The Contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 SHOP PAINTING

- A. Before exposure to weather and prior to shop painting, all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.
- B. All exposed portions of the pumps and motors shall be shop primed, with primer compatible with field painting as specified in Division 9.
- C. All nameplates shall be properly protected during painting.
- D. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance test.

3.03 INSPECTION AND TESTING

- A. General
 - 1. The Engineer shall have the right to inspect, test, or witness tests of all materials or equipment to be furnished under these specifications, prior to their shipment from the point of manufacture.
 - 2. The Engineer shall be notified in writing prior to initial shipment, in ample time so that arrangements can be made for inspection by the Engineer.
 - 3. The Engineer or his representative shall be furnished all facilities, including labor, and shall be allowed proper time for inspection and testing of material and equipment.
 - 4. Materials and equipment shall be tested or inspected as required by the Engineer, and the cost of such work shall be included in the cost of the equipment. The Contractor shall anticipate that delays may be caused because of the necessity of inspection, testing and accepting materials and equipment before their use is approved.
 - 5. The equipment manufacturer shall furnish the services of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than two (2) days in two separate visits to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The first visit will be for checking and inspecting the equipment after it is installed. The second visit will be to operate and supervise the initial field test and for the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled

at least ten days in advance with the Owner and shall take place prior to plant start-up and acceptance by the Owner. The final copies of operation and maintenance manuals specified in Section 01030 and 01730 must have been delivered to the Engineer prior to scheduling the instruction period with the Owner. With the permission of the Engineer, these services may be combined with those provided under 1.06.

6. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Pump

1. After the pump has been completely installed, and working under the direction of the manufacturer, conduct in the presence of the Engineer such tests as are necessary to indicate that the pumping system operates satisfactorily and generally meets the conditions of service specified. The factory-witnessed tests are the basis of equipment efficiency demonstration, the field test shall demonstrate correct mechanical operation after pump start-up. Field tests shall include all components of the pumping and control system included under this section. Supply all labor, equipment and incidentals required to complete the field tests.
2. If the pump and control system performance does not meet the Specifications, corrective measures shall be taken or the pump and/or controls shall be removed and replaced with a pump and/or control which satisfies the conditions specified.

C. Motors

1. The contractor shall megger the motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.
2. The contractor shall check the motor for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The contractor shall check direction of rotation of the motor and reverse connections if necessary.

END OF SECTION

SECTION 11260
CHLORINATION SYSTEM

PART 1 - GENERAL

1.01 Scope

The work under this section includes the furnishing of all labor, materials, equipment, documentation, training and startup services for the manufacture and installation of skid mounted chemical metering systems and one (1) high-density crosslinked polyethylene tank suitable for the application of chemicals and as listed under the Service Conditions and as shown on the drawings and specified herein (the "Work"). Individual system requirements are as indicated at the end of this section.

1.02 Work Specified Herein

A. Equipment

1. Chemical Metering Skids and Accessories
2. Chemical Metering Pumps and Pump Controls
3. High Density Polyethylene Tank
4. Spare Parts

B. Execution

1. Testing
2. Installation
3. Documentation
4. Services

1.03 Related Work Specified Elsewhere

1. Materials and Equipment: Section 01600.
2. Start-up: Section 01650.
3. Process Instrumentation and Controls - Products: Division 13.
4. Electrical: Division 16.

1.04 Quality Assurance

A. Acceptable Manufacturers

1. A single manufacturer, who shall demonstrate previous experience in the design and fabrication of skid-mounted chemical metering systems and high density polyethylene tank, shall provide the products of this section. The

manufacturer shall have a service center with trained direct company employed technicians authorized to make repairs to all components of the chemical feed system located within the State of Florida. This supplier shall be responsible for providing all equipment, accessories, spare parts, documentation, and installation supervision required for a complete and operational chemical feed system.

2. The pump skids shall be a regularly marketed product of the manufacturer who must have a physical plant, technical and design staff, and production personnel to complete the work as specified. Systems assembled by second party fabricators, integrators, equipment distributors/representatives, contractors or manufacturers not normally engaged in chemical metering skid design and manufacturing shall not be acceptable. The chemical metering skids shall be assembled and tested by the manufacturer prior to delivery.
3. The design and fabrication of the chemical metering skids shall comply with the following criteria:
 - a. Systems shall be designed completely in 3D CAD prior to fabrication.
 - b. The metering skid shall be fabricated from white ½" PVC Type 1 sheet that is thermally welded resulting in a unitary piece of construction. Rotationally molded or skeletal frame skid construction is not acceptable.
 - c. The PVC sheet shall be precision cut on state of the art CNC equipment using information from the project specific CAD drawings for each system. Hand cut (non-CNC) sheet construction is not acceptable.
 - d. All piping shall be fabricated to CAD based production drawings that detail all pipe nipples, fittings, valves, metering accessories, clamp locations, etc. These drawings shall become a permanent part of the production file maintained by the manufacturer so that all or any portion of the piping can be pre-fabricated by the manufacturer and replaced in the field without any pipe cutting, gluing, welding etc. required. Hand built or reverse engineered piping assembly not based on CAD drawings is not acceptable.
 - e. All power and control wiring as indicated on the P&I drawings shall terminate in a NEMA 4X terminal junction box (TJB) providing the site electrical contractor with a single point termination for each system. Any devices installed within the metering skid boundary that require power or interface connection to remote systems shall be pre-wired to the TJB by the manufacturer.
 - f. The manufacturer prior to delivery shall hydraulically and electrically test each system. Testing shall be documented and include verification of pump performance and response to remote systems using simulation equipment as required. A copy of the shop test report shall be included in

the final O&M's for the project.

4. The manufacturer shall supply fifteen separate references with contact names and phone numbers, where substantially similar installations for the equipment as specified has been in satisfactory operation for a minimum of two years.
5. The manufacturer shall have a minimum of 5 years experience with a successful record of manufacturing and servicing of systems as specified herein.
6. The manufacturer shall have a proven track record of after market sales and service support on its equipment. A proposal for professional maintenance of the equipment by a factory technician shall be provided in the submittals.
7. The products of this section shall be manufactured by Blue Planet Environmental Systems, Inc. or approved equal.
8. Naming of a manufacturer does not indicate approval nor shall standard product offerings by any named manufacturers be accepted in lieu of component features as specified herein. All manufacturers are required to comply fully with these specifications.

B. Warranties

1. The system manufacturer shall provide a two (2) year warranty for the metering pumps (1-year for liquid end), skid material/construction, and skid-mounted equipment, piping and valves. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself.

1.05 Submittals

- A. Submit shop drawing and product data for the equipment provided. Include detailed schematic of equipment, piping, controls, etc.
- B. Submit a list of the manufacturers recommended spare parts, special tools and lubricants. List shall include local source for supply of all parts and professional service.
- C. Submit upon request, a cross-sectional sample of pipe joining practices for inspection. Only those manufacturers providing acceptable samples will be considered.
- D. Submit five (5) separate references where similar chemical metering systems have been in successful operation for a minimum of 2 years.
- E. Submit a copy of proposed manufacturer's guarantee and local parts/service center information.

1.06 Section Specific Submittals

- A. The information requested in this section is required in order to determine that the manufacturer has the ability and resources to provide equipment that meets the design, fabrication and quality standards as set forth herein. Any submittals that do not include this information shall be returned as “Rejected - Do Not Resubmit”.
- B. In addition to the general submittals as specified herein and elsewhere, the following CAD drawings shall be provided as a part of the submittal package in a section labeled SHOP DRAWINGS for each chemical metering system included in this section. These drawings shall be produced “in-house” by the system manufacturer for the specific equipment to be provided for this project. Marked up copies of general product information is not acceptable.

1. P&I Diagram – The PID shall indicate the following:

- a. All process piping, valves, pumps and accessories installed within the skid boundary including pipe sizes, materials and piping inlet and outlet information.
- b. All skid mounted electrical/instrumentation switches, controls, indicators etc. including voltage and current ratings for any devices that require a power source.
- c. All controls, indicators, inputs, outputs and surge protection devices included in the local skid mounted NEMA 4X terminal junction box.
- d. All controls, indicators, inputs, outputs and surge protection devices included for any remote mounted control or interface panels being provided.

2. Detail Layout Drawing – The detail drawings shall include the following:

- a. Top, front, side and isometric views for the proposed metering systems.
- b. Top, front and side views shall include accurate overall dimensions and location and dimensions for all piping connections.
- c. Isometric view shall include callouts indicating all skid mounted components and piping connections.
- d. A table shall be provided with the quantity, part number, description, P/M kit (if applicable) and recommended maintenance interval for all major equipment items and metering accessories.

3. Terminal box drawing – The terminal box drawings shall include:

- a. Detail drawing of terminal box back panel layout including all panel

mounted components terminals, etc. including details for all field connections.

- b. The back panel drawing shall include a table with quantity, part numbers and descriptions for all devices.
- c. Detail drawing of terminal box door layout including all panel-mounted components (lamps, switches, nameplates, etc.).
- d. The front panel drawing shall include a table with quantity, part numbers and descriptions for all devices.

4. Remote control/interface panel drawings (if required) including:

- a. Detail drawing of back panel layout including all panel mounted components terminals, etc. including details for all field and skid connections.
- b. The back panel drawing shall include a table with quantity, part numbers and descriptions for all devices.
- c. Detail drawing of panel door layout including all panel-mounted components (lamps, switches, nameplates, etc.).
- d. The panel door drawing shall include a table with quantity, part numbers and descriptions for all devices.

C. In addition to the general submittals as specified herein and elsewhere, the following information shall be provided as a part of the submittal package in a section labeled DOCUMENTATION, SPARE PARTS AND SERVICE.

1. Factory Certificates

- a. Copy of manufacturers in-house and field testing certificates.
- b. Copy of manufacturers installation inspection certificate.

2. Spare Parts and Maintenance

- a. Spare Parts List including:
 - Contact information for manufacturer.
 - Contact information for local service and support.
 - Table of spare parts provided as per specifications.
 - Information for any required lubricants.

b. Maintenance Proposal including:

- Price for factory technician to perform normal preventive maintenance including all normal parts, jobsite labor and travel charges. Proposal shall include schedule of services and shall be valid for 1 year.
- Price for all P/M kits and parts required for normal service. Proposal shall be valid for 1 year.

D. In addition to hard copies as specified elsewhere, a copy of the complete approved submittal shall be provided in PDF electronic format with bookmarks and index for easy navigation.

1.07 Service Conditions

1. This project includes chemical metering systems designed for the following chemicals:

Chemical	Feed Rate (gallon/hour)	Concentration	Specific Gravity	Temperature (Deg F)
Sodium hypochlorite	2.0	12.5%	1.173	~78

2. EQUIPMENT

2.01 General

- A. The chemical metering systems shall be completely self-contained and designed to safely feed metered amounts of all chemicals as listed under Service Conditions. Each chemical metering skid shall include chemical metering pumps, accessories, controls and options as indicated at the end of this section. The chemical metering skids will be completely assembled and tested under simulated field conditions using water prior to delivery to the job site. Manufacturer shall provide 2 weeks notice prior to testing of system to allow engineer/owner to make arrangements to witness the testing.

2.02 Chemical Metering Skids

A. Chemical Metering Skids General Description

1. The chemical metering skids shall be constructed from white PVC sheet with a minimum trade thickness of 1/2". The design of the skid shall include gussets and supports as required for all components and shall be self-supporting. All components of the chemical metering system shall be contained within the skid. The skid shall incorporate spill containment capability and feature a 1/2" fpt connection for containment drain piping. The skids shall be manufactured

using continuous welding technology; bolted construction is not acceptable. Pedestals shall be provided to elevate the metering pumps above the skid base. The pedestals shall be bolted to the skid base with non-metallic bolts to allow for future pump/piping modifications.

2. MS Series: For each chemical metering pump the piping system shall include (1) pressure relief valve; (1) pulsation dampener; (1) diaphragm protected pressure gauge; (1) back-pressure/anti-siphon valve; (1) flushing inlet; (1) flushing outlet and all required piping valves and supports. Complete redundancy is required, systems with pumps that share any of the above accessories SHALL NOT BE ACCEPTABLE. Piping shall include isolation valves and unions for all serviceable components. The chemical supply piping shall feature a y-strainer and a calibration column shall be provided and designed for use with any of the metering pumps. The discharge piping shall provide outlets. The pump connections shall be designed with replaceable pipe sections on the suction and discharge via union or flange so that pump replacement or upgrade can be accomplished without cutting into skid piping.
3. The piping shall be attached to the chemical metering skid with a non-metallic corrosion resistant support system. All support channels shall be welded to the skid, bolted supports are not acceptable. The straps shall be removable and reusable to allow for servicing of the system. All inlet/outlet connections, valves and pump accessories shall be clearly labeled on the skid for easy identification.
4. A NEMA 4X terminal box shall be provided on the skid back panel for termination of all wiring. All power and control wiring as indicated on the P&I drawings shall terminate in the NEMA 4X terminal junction box (TJB) providing the site electrical contractor with a single point termination for each system. Any devices installed within the metering skid boundary that require power or interface connection to remote systems shall be pre-wired to the TJB by the skid manufacturer. Any controls, power supplies, isolation relays, etc. that are required shall be provided by the skid manufacturer. A power outlet with weatherproof cover shall be provided for any metering pumps or accessories that require an outlet. The inside cover of the terminal box shall include a wiring diagram detailing the function of all terminals. A local power disconnect switch shall be provided in the terminal junction box. Surge protection shall be provided locally in the skid mounted terminal junction box. Protection shall be provided for the main power supply as well as all analog input and output signals. Surge protection devices shall be as manufactured by EDCO Inc. of Florida.
5. The chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site.

B. Accessories

1. Calibration Columns

- a. A clear calibration column shall be provided in the chemical supply piping of each system. The piping shall be designed for the calibration column to be used with any of the metering pumps. The calibration column shall be self-filling so that the discharge manifold will allow for filling of the calibration column in the event of non-flooded suction conditions. The top of the calibration column shall allow for connection to rigid piping for “vent” return to supply container. Calibration columns may also be used as de-gassing chambers. All materials shall be compatible with chemicals as listed under this section.
2. Pressure Relief Valves
 - a. Pressure relief valves shall be provided in the discharge piping of each metering pump, prior to any valves, to eliminate the buildup of excess pressure in the system. The pressure relief valves shall be fully adjustable from 0 – 150 psi with bodies compatible with chemicals as listed in this section, a Teflon diaphragm and have no metal parts in contact with the chemical. Output of the pressure relief valves shall return to the pump suction header.
3. Pulsation Dampeners
 - a. Gas charged pulsation dampeners shall be provided and sized for a minimum of 90% dampening. Pulsation dampeners shall include gas charge fitting and 316SS pressure gauge. The dampeners shall be installed in the discharge piping of each metering pump, as close to the metering pump discharge check valve as possible. Pulsation dampeners larger than 10 cu. in. shall attach to the piping by ANSI 150# flanges with 316 SS bolts, threaded connections are not acceptable. All materials shall be compatible with chemicals as listed in this section.
4. Diaphragm Protected Pressure Gauges
 - a. 2-1/2” liquid filled pressure gauges with isolators shall be provided for indication of system pressure in the discharge piping of each metering pump. Industrial quality all 316 Stainless Steel gauges shall be utilized. The isolators shall have housings compatible with chemicals as listed in this section with a Teflon diaphragm and suitable liquid fill. The process connection shall feature a SS reinforcement ring not in contact with the chemical. A fabricated PVC bracket shall be provided for each pressure gauge to secure the isolator and prevent lateral movement of the pressure gauge.
5. Back Pressure/Anti-Siphon Valves
 - a. Back pressure/anti-siphon valves shall be provided in the discharge piping of each metering pump to provide constant back pressure at the chemical metering pump discharge and eliminate siphoning. The back

6. Safety Spray Shield (SSS)

- a. When indicated under optional accessories on Table <SECTION #>, a safety spray shield shall be provided to protect operation and maintenance personnel from contact with the chemical. The spray shield shall consist of an adhesive bonded; extruded FRP frame with removable 1/4" clear acrylic top and side panels and a hinged door for access. The spray shield shall be easily removable.

C. Piping

1. Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC)

- a. This specification covers pipe and fittings for pressurized pipe systems manufactured of Rigid Poly (Vinylchloride) (PVC) and Chlorinated Poly (Vinylchloride) (CPVC) material as described below. Fittings covered under this specification include heavy-duty Schedule 80 fittings molded of the material described below. Fittings covered under this specification are tees, elbows, couplings, reducer bushings, crosses, adapters, plugs, caps and flanges.
- b. All pipe and fittings shall bear the company's name or trademark, material designation, size, applicable IPS schedule, and the NSF mark as indicative of compliance with this specification.
- c. All fittings shall be injection molded of PVC fitting compound of cell classification 12454-B and of CPVC fitting compound of cell classification 23447-B as described in ASTM D- 1784 Standard Specification for Rigid Poly (Vinylchloride) Compounds and Chlorinated Poly (Vinylchloride) Compounds.
- d. Workmanship shall be in accordance with good commercial practice. Fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The fittings shall be commercially uniform in color, opacity, density and other physical properties.
- e. All molded threads, internal or external, shall be "blunt start" threads. All threads shall conform to thread standard ANSI/ASME B1 .20.1 for tapered pipe threads. Threads shall measure not more than 11/2 threads large or small when checked with a plug gauge or ring gauge.
- f. Dimensions and tolerances of sockets shall conform to PVC IPS Schedule 40/80 Socket Dimensions. All reducer bushings shall be designed so as to provide for a positive and sufficient grip for cementing bushings in place.

- g. Assembly shall be performed in a controlled shop environment by the skid manufacturer. All pipe shall be squarely cut on precision equipment with the ends chamfered and deburred. All socket welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. A heavy bodied solvent suitable for use with all chemicals as listed under this section shall be used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.

D. Valves

1. Type 21 Ball Valve

- a. All TYPE 21 Ball Valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. The ball valves shall have a pressure rating of 230 psi for sizes 1/2" to 3" and 150 psi for 4" at 70 ° F. Type 21 Ball Valves must carry a two-year guarantee, as manufactured by Asahi/America, Inc.
- b. All ball valves used for chemicals prone to "off-gassing" (e.g. sodium hypochlorite, hydrogen peroxide) shall be vented to avoid entrapment of vapors.

2.03 Chemical Metering Pumps

A. Electronic Metering Pumps

- 1. The chemical metering pump(s) shall be microprocessor-controlled, simplex, solenoid driven, reciprocating, mechanically-actuated diaphragm type. All pumping functions shall be set by membrane-switch keypad and status shall be displayed on an illuminated LCD which is readable at an offset angle of 45 degrees. Keypad will allow for simple scrolling and display of programmed parameters. The housing shall be rated NEMA 4X.
- 2. The power supply shall be 120 VAC, 60 Hz, single phase. The microprocessor is to automatically compensate for supply voltage variations within 15% of the rated voltage such that the frequency of the pump remains constant.
- 3. The liquid end shall be physically separated from the drive unit by a backplate with weep hole creating an air gap. An elastomer shaft wiper seal shall prevent contamination of the solenoid if the primary diaphragm fails. The diaphragm

shall be constructed of a steel core, vulcanized into nylon-reinforced EPDM, with PTFE-faced fluid contact surface.

4. The liquid end shall be Plexiglas (acrylic) with ((EPDM/Viton®)) seals, with built in valve for air bleed, manually adjusted for continuous degassing of process fluid and self-priming against pressure. The suction and discharge valves shall be ball check design.
5. Stroke length control shall be manually adjusted between 100% and 0% with a stroke adjustment knob on the pump face control.
6. Programming shall allow pump to be calibrated so as to display pump output in gallons/hour or liters/hour.
7. The pump shall be equipped with the programmable function of pressure levels to allow pump to operate at reduced pressures from the maximum rated pressure of the pump.
8. The pump shall be equipped with the programmable function of electronic interlocking of the keypad by access code to prevent unauthorized adjustments to the pump.
9. Keypad shall allow for scrolling and display on LCD such parameters as stroke frequency, pump output in gals/hr or L/hr, dosing quantity, and indication of external mode.
10. Stroke frequency control shall be manually adjusted by touch keypads, with the set stroke rate displayed on the LCD. The metering pump shall be capable of receiving a pulse input via optional external control cable such that one pulse gives one pump stroke rate. The pump shall be capable of receiving a remote ON-OFF signal.
11. The pump shall accept an analog signal such that stroke frequency is proportional to 0/4-20mA or 20-4/0mA, the choice of which is programmable at the pump. The pump shall allow the setting of a maximum stroke rate which corresponds to the maximum analog signal, with stroke rate proportional to signal strength below that rate. Programming for curve processing shall also be possible, in which any stroke frequency ratio in proportion to the electrical signal can be configured.
12. The metering pump shall provide a pulsed output for each stroke for run indication that is proportional to stroke rate.
13. The metering pump shall have an integral relay to allow remote annunciation of a fault condition.
14. The metering pumps shall be LMI Series 9 or equal.

2.04 Metering Pump Controls

A. Internal Microprocessor

1. The chemical metering pumps shall feature an internal microprocessor as described in the Chemical Metering Pump section.

2.05 High Density Polyethylene Tank

- A. General description: Tank shall be rotationally-molded, integrally molded flanged outlet IMFO[®], high density crosslinked polyethylene with an oxidation resistant liner system (OR-1000[™]), one-piece seamless construction, cylindrical in cross-section and vertical with flat / sloping bottoms in axis. Tanks shall be adequately vented as prescribed in the manufacturer's manual. Where indicated, tanks shall be provided with ancillary mechanical fittings and accessories. Tanks shall be marked to identify the manufacturer, date of manufacture and serial numbers must be permanently embossed into the tank. Tanks shall be manufactured by Poly Processing Company or approved equal.
- B. Service: Chemical storage tank shall be suited for use under ambient conditions.
- C. High Density Crosslinked Polyethylene resin used in the tank manufacture shall be by Exxon Mobil Chemicals or equal and shall contain ultraviolet stabilizer as recommended by resin manufacturer. Where black tanks are indicated, the resin shall have a carbon black compounded into it. The tank material shall be rotationally molded and meet or exceed the following properties:

Property	Type I XLPE	ASTM Test
Density, gm/cc	0.938-0.944	D1505
Environmental Stress Cracking Resistance, F50, hours, 10% Igepal	>1,000	D1693
Tensile Strength, Ultimate psi, 2-inch/minimum	2,600	D638 Type IV Specimen
Elongation at Break, % ,2-inch minimum	400	D638 Type IV Specimen
Vicat Softening Point	~248 °F	D1525
Impact Brittleness temperature	<- 180 °F	D746
Flexural Modulus, psi	100,000	D790

- D. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. Tank shall be designed using a hoop stress no greater than 600 psi. In NO case shall the tank thickness be less than design requirements per ASTM D 1998.
1. The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

$$T = P \times OD/2SD \text{ or } 0.433 \times SG \times OD \times H \times OD/2SD$$

Where:

T	=	wall thickness, in
P	=	pressure, psi
SG	=	specific gravity, gm/cc
H	=	fluid head, ft
OD	=	outside diameter, ft
SD	=	hydrostatic design stress, 600 psi

- a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187" thick.
2. On closed top tank the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.
3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

Tank Diameter, ft	Min Knuckle Radius, in
less than or equal to 6	1
greater than 6	1-1/2

- E. Tank shall have at least 2 lifting lugs. Lugs shall be designed for lifting the tank when empty.
- F. Unless otherwise indicated, manway shall be 19-in diameter or greater and equipped with an emergency pressure relief device or SAFE-Surge™ Manway.
- G. Unless otherwise indicated, bolted sealed top manway shall be 19- inches or greater and be in locations easily accessible from the nearest worker access position. The sealed manway shall be constructed of polyethylene material. The bolts shall be chemically compatible with the chemical being stored. Gaskets shall be closed cell, crosslinked polyethylene foam, Viton, or EPDM materials.
- H. Design Criteria

Tank Schedule per the following specifications

No. of	Chemical	Fluid Operating	Tank Specific	Resin	Fitting	Gasket	Bolt

Tank	Stored	Temp.	Gravity		Material	Material	Material
2	Sodium Hypochlorite 12.5%	ambient	1.9	XLPE With OR-1000	PVC	Viton	Titanium

1. Fittings

- a. Tank fittings shall be according to the fitting schedule below. Fitting, gasket and bolt material shall be per requirements in section A, or a material that is compatible with the product being stored and shall be a minimum of ¼-in thick. Threaded fittings shall use American Standard Pipe Threads.
- b. Bolted flange bulkhead fittings shall be constructed with one 150-lb flange installed inside the tank and one flange ring installed outside the tank. The flange will be socket or threaded according to specific connection requirements. The head of the bolts shall be encapsulated with polyethylene preventing fluid contact with the metal material. Encapsulated heads shall have a gasket to provide a sealing surface against the flange. Bolt holes shall straddle the principal centerline of the tank.
- c. Integrally Molded Flanged Outlet Fittings (IMFO®). These outlets must be an integral part of the tank, molded from the same material as the tank and provide complete drainage of liquid through the sidewall of the tank. Metal and alloy inserts shall not be used. The tank should be properly supported- either with a high density crosslinked polyethylene cushion or a concrete pad designed for the IMFO®.
- d. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at 6-ft max intervals. Down pipes and fill pipes shall be PVC or material compatible with the chemical stored.
- e. U-Vents: Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F)(iii)(2)(IV)(9). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen if required (Insect screen lessens the tank capacity by 1/3) in accordance with the venting schedule on page 8.
- f. Flange Adapters: Adapters may be used to adapt threaded or socket fitting components to 150-lb flange connections. Adapters shall be of material compatible with the chemical stored.

I. Tank Accesories:

1. Tank Ladder

- a. Fiberglass access ladders shall be provided with the polyethylene chemical storage tanks for manway access. Use proper chemical resistant materials when anchoring to tank dome or sidewall. Safety cages shall be added to ladders as required. Ladders must be designed to OSHA standard 2206; 1910.27.
- b. Ladders must be secured to the tank and secured to the concrete to allow for tank expansion and contraction due to temperature and loading changes. See the manufacturer's Installation Manual.
- c. All ladders shall be designed to meet applicable OSHA 2206; 1910.27 standards for fixed ladders.

2. Restraint System:

- a. Metal components to be galvanized, stainless steel, or painted clips, edge softeners, and tension ring with stainless steel or galvanized cables and clamps.

2.06 SPARE PARTS

A. Spare Parts

- 1. Provide the following spare parts to the OWNER for each chemical metering skid upon delivery of the pump skid. Spare parts shall include all parts required for (2) years of normal maintenance of all components of the chemical metering system. All parts shall be in one box labeled with the Skid ID Information:
 - a. (1) maintenance kits for each chemical metering pump. Maintenance kits shall include but not be limited to diaphragm, check valve seats, gaskets and o-rings.
 - b. (1) Maintenance kits for each pressure relief valve for each pump skid.
 - c. (1) Maintenance kit for each backpressure valve for each pump skid.
 - d. (1) Spare bladder for each pulsation dampener for each pump skid.
 - e. (1) Spare valve of each size for each pump skid.
 - f. (1) Parts list for all serviceable components.

3. EXECUTION

3.01 DELIVERY, SERVICE AND HANDLING

A. The manufacturer shall provide the following services as specified.

- 1. Delivery

- a. Delivery shall be by the manufacturer's own personnel and delivery vehicle. The delivery person shall be capable of giving the contractor guidance on the installation of the system. Delivery by independent freight carrier is unacceptable.
2. Mechanical and Process Start-Up Services
 - a. Provide (1) 8-hour working days of mechanical and process start-up services.
3. Operator Training Services
 - a. Provide (1) 8-hour working day to instruct operating personnel on the operation and maintenance of the system.
4. Handling
 - A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Avoid sharp objects on trailers.
 - B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.
 - C. Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, the manufacturer shall be notified immediately.

3.02 INSTALLATION

- A. Install the chemical metering skids as indicated on the drawings and specified and in compliance with the manufacturer's instructions.
- B. Install the tanks in strict accordance with the manufacturer's Installation Manual and shop drawings.

3.03 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified direct company employed manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.
- B. Tank Testing
 1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.

2. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, or any other defects.
3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1/2 an hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.
4. All tanks shall be hydro-tested for 24 hours prior to commissioning.

3.04 OPERATION & MAINTENANCE MANUALS AND PRODUCTION RECORDS

- A. Operating and maintenance manuals prepared specifically for this project shall be provided. Manuals shall include all procedures, drawings, parts lists, etc. required to instruct personnel unfamiliar with such equipment. Operation and maintenance manuals shall be prepared in accordance with all specifications of this project.
 1. Complete operating and maintenance manuals shall be provided in PDF electronic format with bookmarks and index for easy navigation.
 2. Operating and maintenance manuals shall include a copy of in-house testing certificate.
- B. A detailed database shall be maintained by the manufacturer containing production data for each chemical metering system. The database shall include serial numbers for all serialized components, production drawings, test data, ship dates, start-up dates and all relevant information.

3.05 WARRANTIES

- A. The system manufacturer shall provide a two (2) year warranty for the metering pumps (1-year liquid end), skid material/construction, and skid-mounted equipment, piping and valves. The Contractor shall provide warranty for the integrity of the tanks used for the storage of sodium hypochlorite for three (3) years from the date of installation. The warranty shall cover replacement or repairs against any failure, including but not limited to leaks from any part of the tanks. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself.
- B. The system manufacturer shall pass through any warranties from the equipment suppliers for the pumps, controllers, and other system components manufactured by others.

END OF SECTION

SECTION 11261

HIGH DENSITY CROSSLINKED POLYETHYLENE STORAGE TANKS

PART 1-GENERAL

1.01 Description

- A. The CONTRACTOR shall provide two high density crosslinked polyethylene tanks, each with an integrally molded flanged outlet, IMFO[®], oxidation resistant liner, and accessories per section 2.05, complete and in place, in accordance with the Contract Documents.

1.02 REFERENCES, CODES AND STANDARDS

- A. American Society of Testing Materials (ASTM).
 - 1. D638 Tensile Properties of Plastics
 - 2. D883 Standard Definitions of Terms Relating to Plastics
 - 4. D1505 Density of Plastics by the Density-Gradient Technique
 - 5. D1525 Test Method for Vicat Softening Temperature of Plastics
 - 6. D1693 ESCR Specification Thickness 0.125" F50-10% Igepal
 - 7. F412 Standard Terminology Relating to Plastic Piping Systems
- B. ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings
- C. Building Code: Uniform Building Code, [1997 J Edition] / IBC 2000
- D. ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).
- E. NSF/ANSI Standard 61, AWWA – Drinking Water System Components

1.03 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be approved by the engineer or contractor prior to the manufacturing of the integrally molded flanged outlet, IMFO[®] tank(s). Submit the following as a single complete initial submittal.
Sufficient data shall be included to show that the product conforms to Specification requirements. Provide the following additional information:
 - 1. Integrally molded flanged outlet IMFO[®] tank and Fitting Material
 - a. Resin Manufacturer Data Sheet
 - b. Fitting Material
 - c. Gasket style and material
 - d. Bolt material
 - 2. Dimensioned Tank Drawings

- a. Location and orientation of molded in fitting (IMFO[®]), openings, fittings, accessories, restraints and supports.
 - b. Details of inlet and molded outlet fitting (IMFO[®]), manways, flexible connections, and vents.
- 3. Calculations shall be stamped and signed by a registered, third party engineer where required.
 - a. Wall thickness. Hoop stress shall be calculated using 600 psi @ 100 degrees F.
 - b. Tank restraint system. Show seismic and wind criteria.
- B. Manufacturer's warranty
- C. Manufacturer's unloading procedure and installation instructions
- D. Supporting information of Quality Management System.
- E. Manufacturer's Qualifications: Submit to engineer a list of 5 installations in the same service as proof of manufacturer's qualifications.
- F. Factory Test Report
 - 1. Material, specific gravity rating at 600 psi @ 100 degrees F. design hoop stress.
 - 2. Wall thickness verification.
 - 3. Fitting placement verification including molded in outlet (IMFO[®])
 - 4. Visual inspection
 - 5. Impact test
 - 4. Gel test
 - 5. Hydrostatic test

1.04 QUALITY ASSURANCE

- A. The integrally molded flanged outlet IMFO[®] tanks of the same material furnished under this Section shall be supplied by the manufacturer who has been regularly engaged in the design and manufacture of chemical storage tanks for over 10 years.
- B. Tanks shall be manufactured from virgin materials.

1.05 WARRANTY

- A. The Contractor shall provide warranty for the integrity of the tanks used for the storage of sodium hypochlorite for three (3) years from the date of installation. The warranty shall

cover replacement or repairs against any failure, including but not limited to leaks from any part of the tanks.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Tanks shall be rotationally-molded, integrally molded flanged outlet IMFO[®], high density crosslinked polyethylene with an oxidation resistant liner system (OR-1000[™]), one-piece seamless construction, cylindrical in cross-section and vertical with flat / sloping bottoms in axis. Tanks shall be adequately vented as prescribed in the manufacturer's manual. Where indicated, tanks shall be provided with ancillary mechanical fittings and accessories. Tanks shall be marked to identify the manufacturer, date of manufacture and serial numbers must be permanently embossed into the tank.

2.02 MANUFACTURER

- A. Tanks shall be manufactured by Poly Processing Company or approved equal.

2.03 POLYETHYLENE STORAGE TANKS

- A. Service: Chemical storage tanks shall be suited for use under ambient conditions.
- B. High Density Crosslinked Polyethylene resin used in the tank manufacture shall be by Exxon Mobil Chemicals or equal and shall contain ultraviolet stabilizer as recommended by resin manufacturer. Where black tanks are indicated, the resin shall have a carbon black compounded into it. The tank material shall be rotationally molded and meet or exceed the following properties:

Property	Type I XLPE	ASTM Test
Density, gm/cc	0.938-0.944	D1505
Environmental Stress Cracking Resistance, F50, hours, 10% Igepal	>1,000	D1693
Tensile Strength, Ultimate psi, 2-inch/minimum	2,600	D638 Type IV Specimen
Elongation at Break, % ,2-inch minimum	400	D638 Type IV Specimen
Vicat Softening Point	~248 °F	D1525
Impact Brittleness temperature	<- 180 °F	D746
Flexural Modulus, psi	100,000	D790

- C. Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. Tanks shall be designed using a hoop stress no greater than 600 psi. In NO case shall the tank thickness be less than design requirements per ASTM D 1998.

1. The wall thickness of any cylindrical portion at any fluid level shall be determined

by the following equation:

$$T = P \times OD/2SD \text{ or } 0.433 \times SG \times OD \times H \times OD/2SD$$

Where:

T	=	wall thickness, in
P	=	pressure, psi
SG	=	specific gravity, gm/cc
H	=	fluid head, ft
OD	=	outside diameter, ft
SD	=	hydrostatic design stress, 600 psi

- a. The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187" thick.
2. On closed top tanks the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.
3. The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

Tank Diameter, ft	Min Knuckle Radius, in
less than or equal to 6	1
greater than 6	1-1/2

- D. Tanks shall have at least 2 lifting lugs. Lugs shall be designed for lifting the tank when empty.
- E. Unless otherwise indicated, manways shall be 19-in diameter or greater and equipped with an emergency pressure relief device or SAFE-Surge™ Manway.
- F. Unless otherwise indicated, bolted sealed top manway shall be 19- inches or greater and be in locations easily accessible from the nearest worker access position. The sealed manway shall be constructed of polyethylene material. The bolts shall be chemically compatible with the chemical being stored. Gaskets shall be closed cell, crosslinked polyethylene foam, Viton, or EPDM materials.
- G. Tank colors shall be natural (unpigmented), black (pigmented), or opaque colors as specified by the ENGINEER with written agreement by the tank manufacturer.

2.04 TANK ACCESSORIES

A. Ladder:

1. Fiberglass access ladders shall be provided with the polyethylene chemical storage tanks for manway access. Use proper chemical resistant materials when anchoring to tank dome or

sidewall. Safety cages shall be added to ladders as required. Ladders must be designed to OSHA standard 2206; 1910.27.

2. Ladders must be secured to the tank and secured to the concrete to allow for tank expansion and contraction due to temperature and loading changes. See the manufacturer's Installation Manual.
3. All ladders shall be designed to meet applicable OSHA 2206; 1910.27 standards for fixed ladders.

B. Restraint System:

1. Metal components to be galvanized, stainless steel, or painted clips, edge softeners, and tension ring with stainless steel or galvanized cables and clamps.

2.05 TANKS:

A. Tank Schedule per the following specifications

No. of Tank	Chemical Stored	Fluid Operating Temp.	Tank Specific Gravity	Resin	Fitting Material	Gasket Material	Bolt Material
2	Sodium Hypochlorite 12.5%	ambient	1.9	XLPE With OR-1000	PVC	Viton	Titanium

B. Fittings

1. Tank fittings shall be according to the fitting schedule below. Fitting, gasket and bolt material shall be per requirements in section A, or a material that is compatible with the product being stored and shall be a minimum of ¼-in thick. Threaded fittings shall use American Standard Pipe Threads.
2. Bolted flange bulkhead fittings shall be constructed with one 150-lb flange installed inside the tank and one flange ring installed outside the tank. The flange will be socket or threaded according to specific connection requirements. The head of the bolts shall be encapsulated with polyethylene preventing fluid contact with the metal material. Encapsulated heads shall have a gasket to provide a sealing surface against the flange. Bolt holes shall straddle the principal centerline of the tank.
3. Integrally Molded Flanged Outlet Fittings (IMFO®). These outlets must be an integral part of the tank, molded from the same material as the tank and provide complete drainage of liquid through the sidewall of the tank. Metal and alloy inserts shall not be used. The tank should be properly supported- either with a high density crosslinked polyethylene cushion or a concrete pad designed for the IMFO®.

4. Down Pipes and Fill Pipes: Down pipes and fill pipes shall be supported at 6-ft max intervals. Down pipes and fill pipes shall be PVC or material compatible with the chemical stored.
5. U-Vents: Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F)(iii)(2)(IV)(9). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen if required (Insect screen lessens the tank capacity by 1/3) in accordance with the venting schedule on page 8.
6. Flange Adapters: Adapters may be used to adapt threaded or socket fitting components to 150-lb flange connections. Adapters shall be of material compatible with the chemical stored.

2.06 LEVEL INDICATION

- A. Float Indication: The level indicator shall be assembled to the tank and shall consist of PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, clear PVC sight tube and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time.

2.07 TANK INSULATION AND HEAT TRACING

- A. Not required.

2.08 FACTORY TESTING

A. Material Testing

1. Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.
2. Degree of Crosslinking. Use Method C of ASTM D 1998- Section 11.4 to determine the ortho-xylene insoluble fraction of crosslinked polyethylene gel test. Samples shall test at no less than 65 percent.

B. Tank Testing

1. Dimensions: Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.
2. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, or any other defects.
3. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1/2 an hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

- A. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Avoid sharp objects on trailers.
- B. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.
- C. Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, the manufacturer shall be notified immediately.

3.02 INSTALLATION

- A. Install the tanks in strict accordance with the manufacturer's Installation Manual and shop drawings.

3.03 FIELD TESTING

- A. All tanks shall be hydro-tested for 24 hours prior to commissioning.

END OF SECTION

SECTION 11265

CHEMICAL FEED SYSTEM

PART 1 - GENERAL

1.01 Scope

The work under this section includes the furnishing of all labor, materials, equipment, documentation, training and startup services for the manufacture and installation of two (2) chemical feed systems suitable for the application of alkali and ferric chloride as shown on the drawings and specified herein (the "Work").

1.02 Work Specified Herein

A. Equipment

- A. Chemical storage containers
- B. Chemical Metering Pumps and Pump Controls
- C. Drum-top pump mounting bracket
- D. Spare Parts

B. Execution

- A. Installation
- B. Testing
- C. Documentation
- D. Services

1.03 Related Work Specified Elsewhere

- 1. Materials and Equipment: Section 01600.
- 2. Start-up: Section 01650.
- 3. Process Instrumentation and Controls - Products: Division 13.
- 4. Electrical: Division 16.

1.04 Quality Assurance

- A. The chemical pumps shall be regularly marketed product of the manufacturer who must have a physical plant, technical and design staff, and production personnel to complete the work as specified. The chemical metering skids shall be assembled and tested by the manufacturer prior to delivery.
- B. The manufacturer shall have a proven track record of after market sales and service support on its equipment. A proposal for professional maintenance of

the equipment by a factory technician shall be provided in the submittals.

- C. The products of this section shall be manufactured by Blue Planet Environmental Systems, Inc. or approved equal.

1.05 Submittals

- A. Submit shop drawing and product data for the equipment provided. Include detailed schematic of equipment, piping, controls, etc.
- B. Submit a list of the manufacturers recommended spare parts, special tools and lubricants. List shall include local source for supply of all parts and professional service.

1.06 Service Conditions

- A. The chemical feed systems are designed to meet the following operation conditions during the first five years of the operations based on anticipated flow at ~35% of the full design capacity.

Chemical	Usage Rate (gallon/day)	Pump Capacity (gallon/hour)	Concentration	Specific Gravity	Temperature (Deg F)
Sodium hydroxide	24*	3.0	50%	1.529	~78
Ferric chloride	2.0	0.25	3 M	~2.0	~78

* When treating batches of wastewater with over 50% landfill leachate.

2. EQUIPMENT

2.01 General

- A. The chemical metering systems shall be completely self-contained and designed to safely feed metered amounts of all chemicals as listed under Service Conditions. The contractor shall provide chemical metering pumps, accessories, and controls. The chemical pump fastening brackets shall be completely assembled and tested under simulated field conditions using water prior to delivery to the job site.

2.02 Metering Pump Mounting Brackets

- A. The metering pump mounting bracket shall be designed to secure a chemical pump atop of a 55-gallon plastic drum. It shall be well balanced to prevent tipping over of the pump when the bracket is placed, without fastening, on a flat surface.
- B. The mounting bracket shall be constructed of ½-inch PVC or other chemical- and

weather-resistant material.

C. Siemens Water Technologies Model EZ Drum Shelf or approved equal.

2.03 Calibration Columns

A clear calibration column shall be provided in the chemical supply piping of each system. The piping shall be designed for the calibration column to be used with any of the metering pumps. The calibration column shall be self-filling so that the discharge manifold will allow for filling of the calibration column in the event of non-flooded suction conditions. The top of the calibration column shall allow for connection to rigid piping for “vent” return to supply container. Calibration columns may also be used as de-gassing chambers. All materials shall be compatible with chemicals as listed under this section.

2.04 Pressure Relief Valves

Pressure relief valves shall be provided in the discharge piping of each metering pump, prior to any valves, to eliminate the buildup of excess pressure in the system. The pressure relief valves shall be fully adjustable from 0 – 150 psi with bodies compatible with chemicals as listed in this section, a Teflon diaphragm and have no metal parts in contact with the chemical. Output of the pressure relief valves shall return to the pump suction header.

2.05 Back Pressure/Anti-Siphon Valves

Back pressure/anti-siphon valves shall be provided in the discharge piping of each metering pump to provide constant back pressure at the chemical metering pump discharge and eliminate siphoning. The back pressure valves shall be fully adjustable from 0 – 150 psi with bodies compatible with chemicals as listed in this section, a Teflon diaphragm and have no metal parts in contact with the chemical.

2.06 Piping

- A. All pipe and fittings shall bear the company’s name or trademark, material designation, size, applicable IPS schedule, and the NSF mark as indicative of compliance with this specification.
- B. Workmanship shall be in accordance with good commercial practice. Fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The fittings shall be commercially uniform in color, opacity, density and other physical properties.
- C. All pipe shall be squarely cut on precision equipment with the ends chamfered

and deburred. All socket welded connections shall follow the guidelines set by the pipe/fitting manufacturer for proper cleaning, priming and gluing procedures. A heavy bodied solvent suitable for use with all chemicals as listed under this section shall be used. All threaded connections will utilize Teflon tape, a suitable thread sealant or a combination of both. Threaded connections shall utilize stainless steel reinforcement rings where applicable to reduce the risk of cracking.

2.07 Valves

- A. All TYPE 21 Ball Valves, sizes 1/2" to 4", shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FKM with PTFE seats. PTFE seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The valve handle shall double as carrier removal and/or tightening tool. ISO mounting pad shall be integrally molded to valve body for actuation. The ball valves shall have a pressure rating of 230 psi for sizes 1/2" to 3" and 150 psi for 4" at 70 ° F. Type 21 Ball Valves must carry a two-year guarantee, as manufactured by Asahi/America, Inc.
- B. All ball valves used for chemicals prone to "off-gassing" (e.g. sodium hypochlorite, hydrogen peroxide) shall be vented to avoid entrapment of vapors.

2.08 Chemical Metering Pumps

- A. The chemical metering pump(s) shall be reciprocating, hydraulically-actuated diaphragm type and equipped with variable speed or frequency control from zero to 100% of the rated capacity.
- B. The power supply shall be 120 VAC, 60 Hz, single phase. The microprocessor is to automatically compensate for supply voltage variations within 15% of the rated voltage such that the frequency of the pump remains constant. The housing shall be rated NEMA 4X.
- C. The pumps shall be equipped with built in valve for air bleed, manually adjusted for continuous degassing of process fluid and self-priming against pressure. The suction and discharge valves shall be ball check design. The liquid end shall be physically separated from the drive unit.
- D. Stroke length control shall be manually adjusted between 0% and 100% with a stroke adjustment knob on the pump face control.
- E. The metering pump shall provide a pulsed output for each stroke for run indication that is proportional to stroke rate.
- F. Acceptable manufacturers include LMI and Siemens Water Technologies.

2.09 Chemical Storage Drums

- A. Chemical storage drums shall be of materials suitable for the long-term storage of the chemicals as listed in this section.
- B. Chemical storage drums shall be suited for use under unprotected ambient conditions.

3. EXECUTION

3.01 DELIVERY, SERVICE AND HANDLING

- A. Delivery shall be by the manufacturer's own personnel and delivery vehicle. The delivery person shall be capable of giving the contractor guidance on the installation of the system. Delivery by independent freight carrier is unacceptable.
- B. Handling
 - 1. The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. Avoid sharp objects on trailers.
 - 2. All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.
 - 3. Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, the manufacturer shall be notified immediately.

3.02 INSTALLATION

- A. Install the chemical metering pumps and mounting brackets as indicated on the drawings and specified and in compliance with the manufacturer's instructions.

3.03 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified direct company employed manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.
- B. Drum Testing
 - 1. Visual: Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, or any other defects.

2. Hydrostatic test: Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1/2 an hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.
3. All drums shall be hydro-tested for 24 hours prior to commissioning.

3.04 WARRANTIES

- A. The system manufacturer shall provide a one (1) year warranty for the metering pumps, mounting brackets, drums, piping and valves. The warranty shall cover replacement or repairs against any failure, including but not limited to leaks from any part of the tanks. This warranty shall be in addition to and not in lieu of any warranties provided by the manufacturer of the equipment itself.
- B. The system manufacturer shall pass through any warranties from the equipment suppliers for the pumps, controllers, and other system components manufactured by others.

END OF SECTION

SECTION 11270

AUTOMATIC BACKWASH SAND FILTERS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the complete installation of two (2) sand filters. The filter shall consist of a cylindrical tank with a conical hopper; feed inlet manifold, feed distribution radials; filtrate weir and flume; airlift pipe, internal sand washer, sand distribution cone(s), reject compartment with weir and flume and a compressed air control system. The filter shall operate in a manner such that the total cross-sectional area of each filter shall be in a continuous filtration and a continuous backwash mode. There shall be no interruption of the filtration process by shutting down a part or a whole filter for backwashing
- B. Related Work Described Elsewhere:
 - 1. Material and Equipment: Section 01600.
 - 2. Start-Up: Section 01650.
 - 3. Electrical: Division 16

1.02 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. ASTM -American Society for Testing and Materials
 - 2. AISI -American Iron and Steel Institute
 - 3. AGMA -American Gear Manufacturer's Association
 - 4. NEMA- National Electrical Manufacturer's Association
 - 5. NEC -National Electric Code
- B. To assure unity of responsibility, center tube, discs with filter media panels, support frame with cover over the entire filter, backwash spray assembly with pump, backwash trough, drive mechanism, automatic control system and components as specified shall be furnished and/or coordinated by a single manufacturer
- C. All painting shall be per Manufacturer's standards.

1.03 QUALIFICATIONS

- A. Each manufacturer shall submit a list of at least five U.S. installations on similar applications which have been in continuous operation for at least two years.
- B. To be considered acceptable as alternate process equipment, the manufacturer shall send the Engineer a written request 14 days prior to the bid which is to include such drawings, specifications, literature, performance data, list of installation in US as well as in state of Florida, and other information necessary to describe the proposed equipment as meeting the minimum requirements of the project.
- C. Acceptable manufacturers include Parkson Corporation and Siemens Water Technologies.

1.04 SUBMITTALS

- A. Submit as specified in Division 1.
- B. Shop Drawings: The Contractor shall furnish shop drawings, catalog data, operation and maintenance manuals, installation instructions, parts list, layout drawings, equipment design data, testing data and reports of the new and upgraded filter system to show full compliance with these specifications.
- C. Operating Instructions: The Contractor shall furnish the following:
 - 1. Copies of an operating and maintenance manual shall be furnished in accordance with Section 01730: Operating and Maintenance Data.
 - 2. Instructions shall be prepared specifically for this equipment and installation.
 - 3. Operation and maintenance instructions shall include the following as a minimum: All required equipment cuts; drawings; list of facilities to obtain spare parts for all equipment; and list of manufacturer-approved service organizations for all equipment.
 - 4. A factory representative with complete knowledge of proper operation and maintenance shall be provided for two (2) days to instruct representatives of the Owner and the Engineer on proper operation and maintenance. This work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3 – EXECUTION of this Section. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.05 PERFORMANCE REQUIREMENTS

- A. The automatic backwash sand filter system shall be suitable for filtering domestic wastewater after secondary treatment and clarification. Each filter shall be designed to operate on a continuous basis and shall be designed to operate while receiving varying flows.

B. DESIGN CRITERIA

1. Mechanical Criteria:

- a. The filter shall be a continuous backwash, upflow, standard bed, single- or multi-media filter.
- b. The filter shall operate counter currently. The feed shall be upflow with sand moving downward.
- c. Each tank shall come complete with 150# drilled flanged connections for feed, reject, filtrate, and drain connections.
- d. The filter shall not contain any moving parts.
- e. The filter shall not contain any screens, wedgewires, grids, etc., to retain the media in place.
- f. The air supply system shall consist of a separate panel including an air filter, control valve, air flow meter, pressure regulator and pressure gauge.
- g. The unit shall come complete with access ladder and platform.
- h. The filter shall be designed for Seismic Zone 0 installation.
- i. Influent water feed assembly shall consist feed distribution radials.

2. Process Criteria:

- a. The units shall be designed to filter out suspended solids from a peak flow of 200 U.S. gpm from a secondary biological treatment effluent containing approximately 20 mg/L of TSS.
- b. The filter shall produce a continuous filtrate stream and a continuous reject stream and shall not be shut down for any backwash cycles. No backwash valves, pumps, instrumentation shall be required for backwash cycles.
- c. The sand bed shall be continuously backwashed internally and redistributed on top of the sand bed.

d. Continuous sand cleaning shall be accomplished within the filter using filtered water. Filter influent (feed) shall not be used for sand cleaning.

e. The headloss through the filter shall not exceed 48".

PART 2 – PRODUCTS

2.01 COMPRESSED AIR SYSTEM

- A. The Compressed Air System shall be provided by the same provider of the automatic backwash filter system.
- B. The Compressor Package shall be a completely, pre-piped, pre-wired, compressed air system suitable for and meets the requirements of the automatic backwash filter system operations.
- C. The Compressed Air System shall be complete with a start-up kit, this includes two (2) replacement inlet air filter elements and enough synthetic oil for two (2) complete changes.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Install the automatic backwash sand filter system as indicated on the drawings and specified and in compliance with the manufacturer's instructions.

3.02 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified direct company employed manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.

3.03 OPERATION & MAINTENANCE MANUALS AND PRODUCTION RECORDS

- A. Operating and maintenance manuals prepared specifically for this project shall be provided. Manuals shall include all procedures, drawings, parts lists, etc. required to instruct personnel unfamiliar with such equipment. Operation and maintenance manuals shall be prepared in accordance with all specifications of this project.
 - 1. Complete operating and maintenance manuals shall be provided in PDF electronic format with bookmarks and index for easy navigation.

2. Operating and maintenance manuals shall include a copy of in-house testing certificate.

3.04 WARRANTIES

- A. The new equipment shall materially conform to the description in this Specification and the Contract Documentation and shall be free from defects in material and workmanship. Warranty periods are 18 months from delivery or 1 year from beneficial use, whichever occurs first.

END OF SECTION

SECTION 11287

WEIR AND SLIDE GATES

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, equipment and incidentals required, and install the weir and slide gates and appurtenances as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Material and Equipment: Section 01600.
 - 2. Start-up: Section 01650.
 - 3. Painting: Section 09900.
- C. General Design:
 - 1. All weir/slide gates specified herein shall be mounted as shown on the Drawings.
 - 2. Gate leakage shall not exceed 0.1 gallons per minute (gpm) per foot of seating perimeter for weir/slide gates in a seating head arrangement. Gate leakage shall not exceed 0.2 gpm per foot of seating perimeter for weir/slide gates in an unseating head arrangement.
 - 3. The weir/slide gate shall not deflect more than $1/360$ of the span of the gate under design head measured from water surface to mid-height of gate.
 - 4. Weir/slide gates shall be supplied in accordance with the Weir/Slide Gate Schedules shown on the drawings.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. The weir/slide gates specified under this Section shall be furnished by a manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment furnished with a minimum of five (5) years of experience in that field.

2. The safety factors that shall be used in the design of all of the equipment are as follows: Working stresses shall not exceed the lower value of the one-third (1/3) of the yield strength or one/fifth (1/5) of the ultimate strength of the material. The gates and appurtenances shall be designed for installation in the structures shown on the Drawings.
3. All work shall be performed in accordance with the best modern practice for the manufacture of high-grade machinery. All parts shall conform accurately to the design dimensions and shall be free of all defects in workmanship or material that will impair their service. The slide gates shall be completely shop-assembled to insure the proper fit and adjustment of all parts.
4. All materials shall be new and both workmanship and materials shall be of the very best quality, entirely suitable for the service to which they are to be subjected.
5. All materials shall be of a quality to withstand the corrosion, abrasion and stresses to which this equipment will be subjected during fabrication, erection and continuous operation.
6. Testing:
 - a. The completely assembled gates, in vertical position, shall be shop-inspected for proper seating.
 - b. The gate shall be fully opened and closed in its guide system to insure that it operates freely. Floor stands shall be shop operated to insure proper assembly and operation.

B. Standards:

1. Stainless Steel Weir and Slide Gates: Frame, slides, rails and yokes shall be Type 316 Stainless Steel - ASTM A-276.
2. Aluminum Weir and Slide Gates: Frame, slides, rails and yokes shall be ASTM B-209 and ASTM B-221 Alloy 6061-T6.
3. Flush Bottom Seals and "J" Bulb Seals: ASTM D-2000 rubber.
4. Stems, Fasteners and Anchor Bolts: Stainless Steel - ASTM A-276.

5. Iron castings for bench stands: ASTM A-126, Class B.
- C. Equipment Manufacturers: The gates and all related equipment shall be designed, constructed and installed with the best practices and methods and shall be manufactured by Hydro-Gate Corp., Whipps, Waterman Industries, Washington Aluminum Company, Rodney-Hunt, or approved equal.

1.03 SUBMITTALS

- A. Materials and Shop Drawings:
 1. Copies of all materials required to establish compliance with the specifications shall be submitted in accordance with the provisions of Section 01340: Shop Drawings, Working Drawings and Samples. Submittals shall include at least the following:
 - a. Certified shop and erection drawings and data regarding slide gates.
 - b. Literature on drawings describing the equipment and showing all important details of construction and dimensions.
 2. In the event that it is impossible to conform to certain details of the specifications due to manufacturing techniques, describe completely all nonconforming aspects.
 3. Submittals shall clearly identify the location, method of installation and type of operator for each gate to be provided.
- B. Operating Instructions: Operating and maintenance instructions, for each type of slide weir gate, shall be furnished to the Engineer as provided in Section 01730: Operating and Maintenance Data.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be delivered in suitable packages, cases or crates, and stored or placed as specified in Section 01600: Materials and Equipment. Each package shall have an identifying mark and a complete list showing contents.

1.05 WARRANTY AND GUARANTEES

- A. Refer to Section 01740: Warranties and Bonds.

PART 2 - PRODUCTS

2.01 GENERAL

A. Aluminum Weir/Slide Gates (as indicated in the gate schedules).

1. The weir/slide gates, as specified herein and shown on the Drawings, shall be fabricated aluminum with the guides designed to mount on the face of, or embedded in, concrete.
2. The guides shall be of extruded aluminum incorporating a dual slot design. The primary slot shall accept the plate of the disc and the secondary slot will be sufficiently wide to accept the reinforcing ribs of the disc. The guides shall be designed for maximum rigidity, shall have a weight of not less than three pounds per foot and will be provided with holes for anchor bolts every 12-inches for face mounted units or embedding key ways for embedded units. Guides shall extend beneath the opening a sufficient amount to support the disc in the fully down or open position for downward opening gates, and shall extend above the channel to support the full height of the disc when the gate is fully up, or in the open position for upward opening gates.
3. An aluminum angle shall be welded to the guides across the invert of the opening on face mounted gates and up both sides of all gates. A hollow bulb J-seal shall be attached to this angle with stainless steel strips and attaching bolts. J-seals shall be adjustable and replaceable in the field without removing the gate from the installed position. The seal shall be arranged so that it will deflect a minimum of 1/16-inch.
4. The invert of embedded unit frames shall have an angle welded to the lower ends of the guides to incorporate a flush bottom seal that is attached to the bottom of the frame invert. Seals attached to the slide or disc are not acceptable.
5. Where the guides extend above the operating floor, they shall be sufficiently strong so that no further reinforcing will be required. Where required, the yoke to support the operating benchstand will be formed by two (2) angles welded at the top of the guides to provide a one (1) piece rigid frame. The arrangement of the yoke will be such that the disc and stem can be removed without disconnecting the yoke.
6. The disc or sliding member shall be an aluminum plate reinforced with "U" shaped aluminum extrusions welded to the plate not more than 16-inches apart. The disc shall not deflect more than 1/360 of the span of the gate under the design head. Reinforcing ribs shall extend into the guides so that they overlap the seating surface of the guide.

7. All parts of the gate shall have a minimum thickness of ¼-inch.
8. Gate stem diameter shall be adequate to withstand twice the force created by a 40-lb. pull on the operator. Stems shall have rolled threads with a maximum roughness of 16-micro-inches. The stem shall be properly supported at a spacing to provide an 1/r ration of 200 or less. Gate stem shall be Type 304 stainless steel and of sufficient length to facilitate gate operation (fully open and closed). The stem shall be provided with a threaded bronze stop nut with set screw.
9. All necessary hardware and anchor bolts shall be Type 304 stainless steel and shall be furnished by the gate manufacturer.

B. Operators:

1. Gate operators shall be handwheel or geared crank type as shown on the gate schedule.
2. Gate operators shall be selected so that no more than 40 pounds (lb.) effort on the operator will be required to open or close a gate. Gate operators shall be located at a maximum height of 42-inches above the grating or structure. When the normal yoke elevation is above 42-inches above structure, the geared lift shall be coupled to a 90 degree bevel gear box by means of a floating shaft and lovejoy couplings. This gearbox shall be mounted on the edge of the self-contained yoke. A second gear box will be placed 42-inches above the structure and connected by means of shaft and couplings. All shafts and couplings shall be Type 304 stainless steel and aligned to acceptable coupling tolerance. All cast iron gear box housings shall be epoxy coated in accordance with Section 09900: Painting, for corrosion protection.
3. All operators shall be geared and shall have a weatherproof cast iron housing or pedestal with a bronze operating nut. An effective gear ratio of at least 2:1 is required.
4. Operators shall be grease lubricated and provided with grease fittings.
5. Crank and handwheel operators supplied with floorstands and benchstands shall be self-locking at any position of stem travel. Cranks and handwheels shall be cast iron and hot dip galvanized after fabrication. Cranks shall be no less than 12-inches long and shall be keyed to the operating nut. Handwheels shall not have a diameter greater than 30-inches.

C. Operator Accessories:

1. 316 stainless steel wall brackets shall be used to support floorstands at locations shown on the Drawings. Wall brackets shall be capable of withstanding all normal operating loads, and shall be attached with approved anchor bolts, to the vertical face of the concrete wall directly above the gate. The contractor shall follow all gate and operator manufacturer's installation requirements.
2. All operators shall be provided with a plastic stem cover and rain cap, graduated in intervals of tenths of an inch to show position of gate.

PART 3- EXECUTION

3.01 INSTALLATION

- A. 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 and with Section 01600: Materials and Equipment. Frames and guides shall be installed in a true vertical plane with 90-degree corners.

3.02 INSPECTION AND TESTING

- A. Furnish the services for one (1) day of a factory representative 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, Paragraph 1.01 C.2, 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 11304

EFFLUENT HORIZONTAL SPLIT CASE PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Contractor shall furnish materials, equipment and labor to furnish, install and test the pumping system complete with the pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the contract drawings and as herein specified. The contractor shall furnish two (2) of each pumps for the sequential batch reactor, chlorine contact chamber, and ground storage tank.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Motors: Section 16150
 - 2. Painting: Section 09900.
 - 3. Process Instrumentation and Controls - Products: Division 13.
 - 4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

- A. Qualifications
 - 1. The pumping units specified herein are to be standard pumping units for the intended service. Each pump shall be capable of handling raw sewage solids and stringy materials without clogging, and shall be of first-class modern design and materials, as manufactured by reputable makers of long experience.
 - 2. Unit responsibility. Horizontal split case pump, complete with motor, V-belt, baseplate, necessary guards, control panel, and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
 - 3. The pumps shall be designed for continuous operation and will be operated continuously under normal service. To minimize operation power costs, the

hydraulic efficiencies listed for each pump are the minimum acceptable, and must be guaranteed by the manufacturer.

1.03 SUBMITTALS

- A. Shop Drawings and Manufacturer's Literature: All pumps to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.
 - 1. Manufacturer's literature and illustrations, including the total weight of the equipment and the weight of the single largest item.
 - 2. Manufacturer's certified curves showing pump characteristics of head, discharge, brake horsepower, and efficiency.
 - 3. Shop Drawings, including details of pump assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in pump construction, details of all pump accessories, drive guards and dimensions of major components.
- B. Operation and Maintenance Manuals: For all pumps furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data. In addition to the operating and maintenance manual submittal specified in Section 01730, the submittal shall include the following:
 - 1. General - equipment function, description and normal and limiting operating characteristics.
 - 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 - 3. Operation instructions - start up procedures, normal operating conditions, emergency and normal shutdown procedure.
 - 4. Lubrication and maintenance instructions.
 - 5. Troubleshooting guide.
 - 6. Parts list and predicted life of parts subject to wear.
 - 7. Drawings - cross sectional view, assembly and wiring diagrams.
 - 8. Pump performance curves.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

- A. The pump shall be a single-stage centrifugal horizontal split case pump, Aurora Pump, Peerless Pump, Patterson Pumps, Pacific Pumping Company, or approved equal. Pre-approval must be obtained a minimum of ten days before bid date.

2.02 MATERIALS OF CONSTRUCTION

Casing.....Cast Iron (ASTM A48)

Impeller.....Bronze (ASTM B62)

Shaft.....Carbon Steel (AISI C1045)

Shaft Sleeve.....Bronze (ASTM B62)

Case Wear Ring.....Bronze (ASTM B62)

2.03 PUMPS

A. General

1. The pumps shall be of the horizontal split case type.
2. The pumps shall be of standard dimensions; built to limit gauges or formed to templates, such that parts will be interchangeable between like units.

B. Performance Requirements

The following conditions of service shall be strictly adhered to:

Pump Selection	SBR Effluent	Chlorinated Effluent	GST Effluent
From	SBR EQ Tank	CCC	GST
To	Filter	GST	Sprayfield
Flow (gpm)	400	400	400
Head (ft.)	50	40	225
Power (hp)	7.5	5.0	40

2.04 CASING

- A. The casing will be of the horizontal split case design. The casing shall have tapped and plugged holes for priming, vent and drain.

- B. Removal of the upper half of the casing must allow removal of the rotating element without disconnecting the suction or discharge piping.
- C. The lower half of the casing shall be furnished with cored passageways from the high pressure area of the volute to each seal box for positive lubrication without the use of external flushing lines. The bearing arms shall be cast integrally with the lower half of the casing to assure positive bearing alignment. In no case will bolt on bearing arms be acceptable. Each bearing arm will provide a reservoir area for accumulation of weepage from the stuffing box, and a drilled and tapped opening will be provided at the lower portion to allow piping by the Contractor to the nearest floor drain.

2.05 IMPELLER

- A. The impeller shall be designed to give the characteristics outlined under "Performance". It shall be of the enclosed type, cast in one piece. It shall be furnished all over, the exterior being turned and the interior being furnished smooth and cleaned of all burrs, trimmings and irregularities. The impeller will be dynamically balanced. It shall be held securely to the shaft by a key of ample size and shall be locked in place by threaded shaft sleeves.

2.06 SHAFT SLEEVES

- A. The shaft sleeves shall be extended from the hub of the impeller, through the seal box area, and beyond the gland. They shall be sealed at the impeller hub by a Buna O-ring to prevent pumped liquid from contacting the shaft. They shall be threaded to hold them securely in place, and designed so as to lock the impeller.

2.07 CASE WEARING RING

- A. The pump casing shall be fitted with case wear rings to minimize abrasive and corrosive wear to the casing. The wear rings shall be of the radial type, shall have a shoulder machined around the circumference to match a machined shoulder in the casing to provide two sealing faces and to locate the rings in the casing. The rings shall be securely located from rotation by means of pins to the lower casing half.

2.08 STUFFING BOX

- A. A stuffing box shall be provided on each side of the pump casing, designed with sufficient area for incorporation of either packing rings or mechanical seals.

2.09 PACKING

- A. Each stuffing box shall be fitted with rings of die-cut non-asbestos packing material constructed of interwoven graphite coated acrylic.

2.10 PACKING GLAND

- A. Each stuffing box shall be furnished with a two-piece gland to securely hold the packing in place. The gland pieces shall be split to allow access to the packing without disassembly of the unit. Control of weepage shall be accomplished by the use of adjustable swing bolts.

2.11 SHAFT

- A. The pump shaft shall be one-piece, finished and polished on all sections. The shaft shall be of ample strength and rigidity and the shortest practicable distance between bearings shall be used to keep deflection and vibration to a minimum. The maximum allowable deflection of the shaft is 0.002" at any point of operation on the pump curve.

2.12 BEARINGS

- A. The pump shall be supplied with a single row inboard bearing primarily for radial loads and a double row outboard bearing primarily for thrust loads. Both bearings shall be regreaseable lubrication ball type, designed for 250,000 hours average life.
- B. Each bearing shall be mounted in a machined housing that is moisture and dust proof. The housing shall have registered fits to assure alignment, pinned to prevent rotation, and bolted to the bearing arms.
- C. Each housing shall be supplied with a grease fitting and a plugged relief port.

2.13 COUPLING

- A. A flexible coupling shall be provided to connect the pump shaft to the motor shaft. The coupling shall be of an all metal type with a flexible rubber insert. The entire rotating coupling element shall be closed by a coupling guard.

2.14 BASEPLATE

- A. The pump and motor shall be mounted on a groutable steel base plate or a steel drip rim base plate with integral drip channels incorporated on each side. Each channel shall include an NPT connection and plug. The base shall be sufficiently rigid to support the pump and motor without the use of additional supports or members.

2.15 MOTOR

- A. The motor shall be horizontal and in accordance with table in 2.03 and Section 16150, the latest NEMA standards, and shall have the following characteristics:
- B. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating

of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.
- C. Pump bases shall be rigidly and accurately anchored into position, and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the contractor. Anchor bolts shall be set by the contractor in accordance with the manufacturer's recommendations.

3.02 INSPECTION AND FACTORY TESTS

- A. Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.03 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11305

HORIZONTAL NON-CLOG SCREW CENTRIFUGAL PUMPS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall furnish materials, equipment and labor to furnish, install and test the horizontal non-clog screw centrifugal pumps complete with pumps, motors, mounting bases, piping, valves and appurtenances, as indicated on the contract drawings and as herein specified.

B. Related Work Described Elsewhere:

1. Materials and Equipment: Section 01600.
2. Painting: Section 09900.
3. Process Instrumentation and Controls - Products: Division 13.
4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The pumping units specified herein are to be standard pumping units for the intended service. Each pump shall be capable of handling raw sewage solids and stringy materials without clogging, and shall be of first-class modern design and materials, as manufactured by reputable makers of long experience.
2. Unit responsibility. Horizontal non-clog screw centrifugal pumps, complete with motor, V-belt, baseplate, necessary guards, control panel, and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.
3. The pumps shall be designed for continuous operation and will be operated continuously under normal service. To minimize operation power costs, the hydraulic efficiencies listed for each pump are the minimum acceptable, and must be guaranteed by the manufacturer.

1.03 SUBMITTALS

- A. Shop Drawings and Manufacturer's Literature: All pumps to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.
1. Manufacturer's literature and illustrations, including the total weight of the equipment and the weight of the single largest item.
 2. Manufacturer's certified curves showing pump characteristics of head, discharge, brake horsepower, and efficiency.
 3. Shop Drawings, including details of pump assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in pump construction, details of all pump accessories, drive guards and dimensions of major components.
- B. Operation and Maintenance Manuals: For all pumps furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data. In addition to the operating and maintenance manual submittal specified in Section 01730, the submittal shall include the following:
1. General - equipment function, description and normal and limiting operating characteristics.
 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 3. Operation instructions - start up procedures, normal operating conditions, emergency and normal shutdown procedure.
 4. Lubrication and maintenance instructions.
 5. Troubleshooting guide.
 6. Parts list and predicted life of parts subject to wear.
 7. Drawings - cross sectional view, assembly and wiring diagrams.
 8. Pump performance curves.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

- A. The equipment covered by these specifications is intended to be standard pumping equipment of proven ability as manufactured by reputable concerns having long experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown on the Drawings.
- B. All parts shall be so designed and proportioned as to have liberal strength and stiffness, and to be especially adapted from the work to be done. Ample room and facilities shall be provided for inspection, repairs, and adjustment.
- C. Pump bases shall be rigidly and accurately anchored into position, precisely leveled and aligned, so that the completed installation is free from stress or distortion. All necessary foundation bolts, plates, nuts and washers shall be furnished and installed by the Contractor and shall conform to the recommendations and instructions of the equipment manufacturer. Anchor bolts, nuts, and washers shall be of Type 304 stainless steel. Grouting under bases after the equipment is set is included as work under this section.
- D. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and any other pertinent data shall be attached to each pump.
- E. Stainless steel nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes and all other pertinent data shall be attached to each motor.
- F. The nameplate ratings for the motors shall not be exceeded, nor shall the design service factor be reduced when its pump is operating at any point on its characteristic curve at maximum speed.
- G. All pumps shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without cavitations, and without excessive vibration or strain. All pumps shall be designed for outdoor service, and equipped with 7-day, 24-hour timers.

2.02 MATERIALS OF CONSTRUCTION

Casing.....Cast Iron (ASTM A48)

Impeller.....Bronze (ASTM B62)

Shaft.....Carbon Steel (AISI C1045)

Shaft Sleeve.....Bronze (ASTM B62)

Case Wear Ring.....Bronze (ASTM B62)

2.03 PUMPS

A. General

1. The pumps shall be of the horizontal volute screw centrifugal, non-clog, solids handling type for outside installation.
2. The pumps shall be of standard dimensions; built to limit gauges or formed to templates, such that parts will be interchangeable between like units.

B. Performance Requirements

All pumps shall be constant speed with soft start. The following performance conditions shall be strictly adhered to:

No.	Function/Location	Flow (gpm)	TDH (feet)	Min. Eff.	Media
1	SBR #1 circulation	1650	22	80%	Mixed liquor
2	SBR #2 circulation	1650	22	80%	Mixed liquor
3	SBR circulation common spare	1650	22	80%	Mixed liquor
4	SBR EQ tank effluent to filters	400	50	70%	Decanted effluent
5	SBR EQ tank effluent to filters spare	400	50	70%	Decanted effluent
6	Chlorine chamber to storage tank	400	50	70%	Filtered effluent
7	Chlorine chamber to storage tank spare	400	50	70%	Filtered effluent
8	Storage tank to sparyfield	400	225	70%	Filtered effluent
9	Storage tank to sparyfield spare	400	225	70%	Filtered effluent

2.04 PUMP CASING

- A. The pump casings shall be of the top centerline self venting or tangential design, designed for the type service herein specified and be constructed of close grained cast iron meeting ASTM A48, Class 30. Casings shall be designed to permit rear impeller pull out and shall have connections for vents, drains and gauges and shall have a minimum thickness of 0.375 inch. The case on pumps 5-inches and larger shall be provided with a hand-hole cleanout contoured to the case design.
- B. Casings shall be fitted with the appropriate size ANSI Class 125 flange connection.
- C. Casings shall be given a certified hydrostatic test to 75 psi for five (5) minutes with no sign of leakage. Test results shall be sealed by a registered professional Engineer and submitted for approval prior to shipment.

- D. No stationary guides will be permitted on either the suction or discharge sides of the casing.

2.05 IMPELLER

- A. The pump impeller shall be of the non-clogging type and shall be heat-treated ductile or cast iron with a minimum Brinnell Hardness of 250 BHN and shall be statically and dynamically balanced. The pump manufacturer shall be fully responsible for the vibration-free operation of the pumping unit throughout the entire operating range. Positively aligned stationary rotating elements shall be acceptable if provided with radial type wear rings.
- B. The impeller shall be capable of passing a minimum sphere size of 3" and shall be securely fastened to the shaft by means of a stainless steel key and impeller locknut or case hardened locking cap screw. Axial adjustment of the impeller shall be external through integral jack screws or shims.

2.06 PUMP SHAFT

- A. The pump shaft shall be constructed of high-grade carbon steel accurately machined.
- B. The pump shaft shall be protected from wear by a corrosion and wear resisting hardened stainless steel shaft sleeve having a 400 minimum brinell hardness. Shaft deflection shall be no greater than .002-inch through stuffing box with pump running at shut-off condition. Pump shaft shall not be less than 2-inch diameter through the bearing frame. Units incorporating a smaller diameter shaft design will not be considered equal in construction.

2.07 BEARING FRAME

- A. The pump bearing frame shall be equipped with a bearing system designed to accept all thrust loadings and the radial loads imposed by the pump impeller. All bearings shall be designed for a 50,000 B-10 bearing life for any point within the pump operating conditions. The manufacturer shall provide bearing calculations with submittal packages including certification from a registered professional engineer from the factory.
- B. The bearing shall be of grease lubricated design and shall be provided with vents.
- C. All bearing shall be accessible while the pump is in operation. The bearings shall be grease lubricated and a relief shall be provided so that excessive grease pressure will not damage the bearings.
- D. For protection of bearings during shipment and installation, the bearings shall be properly processed with a high quality rust preventative. Each bearing frame shall be

designed so that the complete rotating element can be removed from casing without disconnecting piping.

- E. The bearing support frame shall be fabricated steel or Class 30 cast iron construction and shall be designed to provide a self-centering and self-indexing fit with the wetted end of the pump.
- F. The bearing frame shall contain external provision for axial adjustment of the rotating element to provide a proper clearance between the impeller and suction cover over the life of the pump. Adjustment shall be accomplished with integral jacking screws or shims.

2.08 MECHANICAL SEAL

- A. The seal box shall be engineered specifically for double mechanical seals. The seal box shall be designed for the compressed seal length and shall not require any adjustments. The seal housing shall be extra large to provide excellent circulation of clear sealing liquid. The housing shall have two 1/2-inch in and out tapped openings 180 degrees apart for the sealing water connection.
- B. The complete seal box shall be removable as an assembly.
- C. The standard hardened stainless steel shaft sleeve design shall be provided with a snap ring. This snap ring design shall allow the sleeve and the completely assembled seal box to be removed intact. Reassembly shall be accomplished in the same manner.
- D. The seal shall be of the end face, self cleaning type with non clogging springs, positive positioning and drive, precision lapped carbon primary ring and tungsten carbide mating ring, 316 stainless steel gland, Viton "O" rings and 316 stainless steel or Hastelloy C metal parts. Seal shall be Chesterton Model 880, John Crane, or equal.

2.09 PUMP SUPPORT

- A. Each pump and motor shall be mounted on a fabricated steel pump support base of sufficient size and strength to support all loads to which it may be subjected, as shown on the drawings. Base support shall be suitable to carry the entire weight of the supplied pump and motor unit.

2.10 MOTOR

- A. The motor shall be horizontal and in accordance with Section 16150, the latest NEMA standards. All motors shall be three-phase, 230/460 Volt, 60 Hertz, 1750 RPM, and totally enclosed, fan-cooled (TEFC). The motors shall have the following characteristics:

No.	Function/Location	Horsepower (HP)
1	SBR #1 circulation pump	15
2	SBR #2 circulation pump	15
3	SBR circulation common spare pump	15
4	SBR EQ tank effluent pump to filters	7.5
5	SBR EQ tank effluent pump to filters spare	7.5
6	Chlorine chamber effluent pump to storage tank	7.5
7	Chlorine chamber effluent pump to storage tank spare	7.5
8	Plant final effluent pump to sparyfield	40
9	Plant final effluent pump to sparyfield spare	40

- B. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor, regardless of service factor. The motor shall have a service factor of at least 1.15. The service factor is reserved for variations in voltage and frequency.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.
- C. Pump bases shall be rigidly and accurately anchored into position, and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the contractor. Anchor bolts shall be set by the contractor in accordance with the manufacturer's recommendations.

3.02 FIELD PAINTING

- A. Field painting is specified under Section 09905. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.03 INSPECTION AND FACTORY TESTS

- A. Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.04 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11306
GRINDER PUMP STATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall furnish materials, equipment and labor to furnish, install and test one (1) grinder pump station complete with pump, motor, integral level switch, valves and appurtenances from the administrative office to the headworks, as indicated on the contract drawings and as herein specified.

B. Related Work Described Elsewhere:

1. Materials and Equipment: Section 01600.
2. Painting: Section 09900.
3. Process Instrumentation and Controls - Products: Division 13.
4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The grinder pump station unit specified herein is to be standard units for the intended service. The pump shall be capable of handling raw sewage solids and stringy materials without clogging, and shall be of first-class modern design and materials, as manufactured by reputable makers of long experience.
2. Unit responsibility. The complete grinder pump station unit and all specified accessories and appurtenances shall be furnished by the same source to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

1.03 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature: All pumps to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.

1. Manufacturer's literature and illustrations, including the total weight of the equipment and the weight of the single largest item.
 2. Manufacturer's certified curves showing pump characteristics of head, discharge, brake horsepower, and efficiency.
 3. Shop Drawings, including details of pump assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in pump construction, details of all pump accessories, drive guards and dimensions of major components.
- B. Operation and Maintenance Manuals: For all pumps furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data. In addition to the operating and maintenance manual submittal specified in Section 01730, the submittal shall include the following:
1. General - equipment function, description and normal and limiting operating characteristics.
 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 3. Operation instructions - start up procedures, normal operating conditions, emergency and normal shutdown procedure.
 4. Lubrication and maintenance instructions.
 5. Troubleshooting guide.
 6. Parts list and predicted life of parts subject to wear.
 7. Drawings - cross sectional view, assembly and wiring diagrams.
 8. Pump performance curves.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

- A. The equipment covered by these specifications is intended to include a complete sewage pumping station for the administrative office. The grinder pump station shall consist of a grinder pump, tank, and integrated motor controls and level-sensing.

- B. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as per manufacturer's instructions. The E/One Model DH071 simplex grinder pump station or approved equal.

2.02 PERFORMANCE REQUIREMENTS

The pump shall be constant speed and meet the following performance conditions:

Flow rate: 10 gpm at 60 feet of total dynamic head.

2.03 PUMP

The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene material with high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, and suitable for domestic wastewater service. Buna-N is not acceptable as a stator material.

2.04 GRINDER

The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder impeller shall be a one-piece cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque. These materials have been chosen for their capacity to perform in the intended environment as they are materials with wear and corrosive resistant properties.

This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second to minimize jamming. In order to ensure this maximum inlet velocity, the inlet shroud shall have a minimum diameter of 5 inches.
3. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.
4. The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

2.05 ELECTRIC MOTOR

As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. The wet portion of the motor armature must be 300 Series stainless. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

2.06 MECHANICAL SEAL

The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

2.05 TANK AND INTEGRAL ACCESSWAY

- A. The tank shall be a Wetwell/Drywell design made of high density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring. The corrugations of the outside wall are to be a minimum amplitude of 1-1/2" to provide necessary transverse stiffness. Any incidental sections of a single wall construction are to be 0.250" thick (minimum). All seams created during tank construction are to be thermally welded

and factory tested for leak tightness. The tank wall and bottom must withstand the pressure exerted by saturated soil loading at maximum burial depth. All station components must function normally when exposed to 150 percent of the maximum external soil and hydrostatic pressure.

- B. The tank shall be furnished with one EPDM grommet fitting to accept a 4.50" OD DWV or Schedule 40 pipe. The tank capacities shall be as shown on the contract drawings. The Drywell accessway shall be an integral extension of the Wetwell assembly and shall include a lockable cover assembly providing low profile mounting and watertight capability. The accessway design and construction shall enable field adjustment of the station height in increments of 4" or less without the use of any adhesives or sealants requiring cure time before installation can be completed.
- C. The station shall have all necessary penetrations molded in and factory sealed. To ensure a leak free installation no field penetrations will be acceptable. All discharge piping shall be constructed of 304 stainless steel. The discharge shall terminate outside the accessway bulkhead with a stainless steel, 1-1/4" Female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 235 psi WOG; PVC ball valves or brass ball/gate will not be accepted. The bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.
- D. The accessway shall include a single NEMA 6P Electrical Quick Disconnect (EQD) for all power and control functions, factory installed with accessway penetrations warranted by the manufacturer to be watertight. The EQD will be supplied with 32', 25' of useable Electrical Supply Cable (ESC) outside the station, to connect to the alarm panel. The ESC shall be installed in the basin by the manufacturer. Field assembly of the ESC into the basin is not acceptable because of potential workmanship issues. The EQD shall require no tools for connecting, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. A junction box shall not be permitted in the accessway due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required. The accessway shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank.

2.06 ANTI-SIPHON VALVE

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the stainless steel discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are

not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-siphon port shall be no less than ¾-inch diameter.

2.07 CORE UNIT

The grinder pump station shall have a cartridge type, easily removable core assembly consisting of pump, motor, grinder, all motor controls, check valve, anti-siphon valve, level controls, electrical quick disconnect and wiring. The core unit shall be installed in the basin by the manufacturer. Field assembly of the pump and controls into the basin is not acceptable. The core unit shall seal to the tank deck with a stainless steel latch assembly. The latch assembly must be actuated utilizing a single quick release mechanism requiring no more than a half turn of a wrench. The watertight integrity of each core unit shall be established by a 100 percent factory test at a minimum of 5 PSIG.

2.11 CONTROLS

- A. All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating the motor starting controls in a plastic enclosure is not acceptable. The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. The level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump. The level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.
- B. Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.
- C. All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure

switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes.

- D. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump shall be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory installed NEMA 6P EQD half attached to it

2.12 ALARM PANEL

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the sewage wet-well rises above the alarm level, audible and visual alarms are activated.
2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.
3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

The entire alarm panel shall be listed by Underwriters Laboratories, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. The contractor shall submit a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 FIELD PAINTING

- A. Unless otherwise specified in this section, field painting is specified under Section 09905. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.03 INSPECTION AND FACTORY TESTS

- A. Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.04 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11307
SUMP PUMP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall furnish materials, equipment and labor to furnish, install and test one (1) sump pump with motor, integral level switch, valves and appurtenances to transfer collective wastewater from the in-plant wet well to the headworks, as indicated on the contract drawings and as herein specified.

B. Related Work Described Elsewhere:

1. Materials and Equipment: Section 01600.
2. Painting: Section 09900.
3. Process Instrumentation and Controls - Products: Division 13.
4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The sump pump specified herein is to be standard units for the intended service. The pump shall be capable of handling combined in-plant wastewater with solids and stringy materials without clogging as manufactured by reputable makers of long experience.
2. Unit responsibility. The complete sump pump unit and all specified accessories and appurtenances shall be furnished by the same source to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

1.03 SUBMITTALS

A. Shop Drawings and Manufacturer's Literature: All pumps to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.

1. Manufacturer's literature and illustrations, including the total weight of the equipment and the weight of the single largest item.
 2. Manufacturer's certified curves showing pump characteristics of head, discharge, brake horsepower, and efficiency.
 3. Shop Drawings, including details of pump assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in pump construction, details of all pump accessories, drive guards and dimensions of major components.
- B. Operation and Maintenance Manuals: For all pumps furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data. In addition to the operating and maintenance manual submittal specified in Section 01730, the submittal shall include the following:
1. General - equipment function, description and normal and limiting operating characteristics.
 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 3. Operation instructions - start up procedures, normal operating conditions, emergency and normal shutdown procedure.
 4. Lubrication and maintenance instructions.
 5. Troubleshooting guide.
 6. Parts list and predicted life of parts subject to wear.
 7. Drawings - cross sectional view, assembly and wiring diagrams.
 8. Pump performance curves.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

- A. The equipment covered by these specifications is intended to include a complete functional pumping system to transfer in-plant wastewater from the collection wet well to the headworks. The sump pump shall consist of a pump, slide rail, and integrated motor controls and level-sensing.

- B. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as per manufacturer's instructions. The Goulds/ITT Model HSU, size 4x4-10 or approved equal.

2.02 PERFORMANCE REQUIREMENTS

The pump shall be constant speed and meet the following performance conditions:

Flow rate: 200 gpm at 60 feet of total dynamic head.

2.03 PUMP

The pump shall be a custom designed, submersible, vertical rotor, motor driven, solids handling pump with mechanical seal. All pump castings shall be cast iron. The impeller shall be fully recessed to allow large sized solids (minimum 4-inch diameter) and stringy or fibrous material to pass through without binding or clogging. The pump shall have cast-in elbow and integral supporting legs for durability.

2.04 ELECTRIC MOTOR

- A. The motor shall be a 5 HP, 1725 RPM, 230/460 Volt 60 Hertz, 3 Phase, permanently lubricated and sealed ball bearings, with Class F installation and 1.15 service factor standard. The motor shall have tandem mechanical seals form complete protection of motor internals. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.
- B. The motor shall be protected by internal dual moisture probes for early detection of seal failure.
- C. The motor shall be UL and CSA approved explosion proof design and conform to NEMA, IEEE, ANSI, and NEC standards.

2.05 SLIDE RAIL SYSTEM

The pump shall be mounted on a slide rail system for easy removal. The slide rail system shall allow the removal of the pump without disturbing the discharge piping by utilizing a locking cam action with locator lugs and O-ring for positive sealing

2.07 ALARM PANEL

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel.

The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the wet-well rises above the alarm level, audible and visual alarms are activated and may be silenced by means of the externally mounted, push-to-silence button.
2. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

The visual shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

The entire alarm panel shall be listed by Underwriters Laboratories, Inc.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. The contractor shall submit a certificate stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 FIELD PAINTING

- A. Unless otherwise specified in this section, field painting is specified under Section 09905. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.03 INSPECTION AND FACTORY TESTS

- A. Each centrifugal pump furnished under these specifications shall be tested at the factory to verify individual performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment. Each unit shall be hydrostatically tested in accordance with the Hydraulic Institute Standards.

3.04 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11360

POSITIVE DISPLACEMENT BLOWERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The contractor shall provide all labor materials, equipment and services necessary for furnishing Positive Displacement Blowers. The blowers shall be furnished completely packaged with all accessories, including noise attenuation enclosures, tested and ready for operation. Packages knocked down for shipment are not acceptable.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Process Instrumentation and Controls - Products: Division 13.
 - 4. Electrical: Division 16.
- C. Two (2) new blowers shall be used for the sludge digesters and three (3) new blowers will be used for the sequential batch reactors (SBR). Each blower shall be housed in a sound attenuating enclosure. The blowers, sound attenuating enclosures and appurtenances shall be located in a building. Air from each blower discharge header will flow through a meter to each of the two sludge digesters and SBR's.
- D. The blower systems shall provide for variable flow through the use of pulleys and belts, to give at least three different blower speeds and flow rates.
- F. The blowers shall be or proven equivalent models manufactured by Roots, Sutorbilt, Aerzen Delta Blowers, or others.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer or Packager Qualifications: Supplier shall have experience in providing similar equipment, and shall show evidence of satisfactorily operating installations in the United States.
 - 2. Blower Packagers must be an Authorized Distributor or Representative of the blower being supplied.
 - 3. Blower supplier must be Factory Authorized to perform all phases of warranty work.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM)
 - a) ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 - b) ASTM A530 - Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
 - c) ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
 - d) ASTM A743 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium- Nickel, Corrosion Resistant for General Application.
2. Compressed Air and Gas Institute (CAGI)
 - a) CAGI S5.1 - PNEUORP Test Code for the Measurement of Sound from Pneumatic Equipment.
3. American Iron and Steel Institute (AISI)
4. American Gear Manufacturers Association (AGMA)
5. National Electrical Manufacturers Association (NEMA)
6. American Bearing Manufacturers Association (ABMA)
7. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 SUBMITTALS:

- A. Blower Package Manufacturers must provide a statement in letter form from the actual blower manufacturer certifying that their package design and quality of workmanship is factory approved and in no way will affect the new machine warranty provided by the manufacturer.
- B. Shop Drawings and Manufacturer's Literature: All blowers to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples.
 1. Manufacturer's literature and illustrations, including the total weight of the equipment and the weight of the single largest item.
 2. Manufacturer's certified curves showing blower characteristics of head, discharge, brake horsepower, and efficiency.

3. Shop Drawings, including details of blower assembly and installation layouts and procedures, motor control wiring diagrams, types of materials used in blower construction, details of all blower accessories, belt, pulleys, drive guards, and dimensions of major components.
- C. Operation and Maintenance Manuals: For all blowers furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data. In addition to the operating and maintenance manual submittal specified in Section 01730, the submittal shall include the following:
1. General - equipment function, description and normal and limiting operating characteristics.
 2. Installation instructions - assembly procedures and alignment and adjustment procedures.
 3. Operation instructions - start up procedures, normal operating conditions, and emergency and normal shutdown procedure.
 4. Lubrication and maintenance instructions.
 5. Troubleshooting guide.
 6. Parts list and predicted life of parts subject to wear.
 7. Drawings - cross sectional view, assembly and wiring diagrams.
 8. Blower performance curves.
- D. Blower Curves:
1. Each blower shall be submitted for a blower curve from an identical blower to include head/capacity/HP/efficiency to prove that the blowers supplied conform to the requirements of these Specifications. The data shall be submitted on an 8-1/2-inch by 11-inch sheet, at as large a scale as is practical. The curves shall be plotted from no flow at shut-off head to maximum flow at minimum head specified. No shipment of the blowers is to be made until after the Engineer's approval of the blower curves is obtained.
- E. Noise level measurement results at 3 feet from the blower enclosure.
- F. Certifications: The Contractor shall furnish the Engineer with a written certification signed by the manufacturer's representative that the equipment has been properly installed and lubricated, is in accurate alignment, is free from undue stress imposed by piping or mounting bolts, and has been operated under simulated full load conditions and that satisfactory operation has been obtained.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The equipment furnished shall be designed, constructed, and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed as shown on the Drawings.
- B. All parts shall be so designed and proportioned as to have liberal strength and stiffness, and to be especially adapted from the work to be done. Ample room and facilities shall be provided for inspection, repairs, and adjustment.
- C. Blower bases shall be rigidly and accurately anchored into position, precisely leveled and aligned, so that the completed installation is free from stress or distortion. All necessary foundation bolts, plates, nuts and washers shall be furnished and installed by the Contractor and shall conform to the recommendations and instructions of the equipment manufacturer. Anchor bolts, nuts, and washers shall be of Type 304 stainless steel. Grouting under bases after the equipment is set is included as work under this section.
- D. The blower manufacturer shall furnish the drive motors and factory-mount them on a common base with the blowers.
- E. The blowers, motors, silencers, sound attenuating enclosures and accessories shall be designed to insure the sound pressure level does not exceed 80 dBA at a distance of 3-ft from any component, when tested in accordance with the CAGI S5.1. The equipment shall be tested in an arrangement similar to the equipment to be furnished herein. The test shall include the noise from the motor. The test results shall be submitted to the Engineer.
- F. Stainless steel, brass, or aluminum nameplates giving the name of the manufacturer, the rated capacity, head, speed, and any other pertinent data shall be attached to each blower. Similar nameplates giving the name of the manufacturer, serial number, model number, horsepower, speed, voltage, amperes and all other pertinent data shall be attached to each motor.
- G. The nameplate ratings for the motors shall not be exceeded, nor shall the design service factor be reduced when its blower is operating at any point on its characteristic curve at maximum speed.
- H. All blowers shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating and without excessive vibration or strain. All blowers shall be equipped with 7-day, 24-hour timers.

2.02 MATERIALS AND EQUIPMENT

A. Blowers

1. Design Criteria:

- a. The blowers shall meet the following design criteria:

Blower Selection	Unit	SBR	Digester
Head Req.	psig	10	10

Air Flow Rate	scfm	360	200
Min. Blower Efficiency	Percent	65%	65%
Blower Power Req.	HP	20	15
No. of Units	Unit	3	2

2. The air blowers shall be fabricated, assembled and located as shown on the drawings. Blowers may not operate over 80% of their maximum speed.
3. Blowers shall be of the rotary, positive displacement type. Each assembly shall be rugged in construction and of such design that it may be disassembled and all parts inspected without disturbing the inlet or discharge piping.
4. Casing shall be of one piece with separate headplates, and shall be made of close grained gray cast iron suitably ribbed to prevent distortion under the specified service conditions.
5. Fabricate drive end and gear end headplates of close grained cast iron which are precision machined for exact bearings housing fit.
6. Impeller and shaft shall be made from common cast iron. Impeller shall be of the straight, two lobe involute type and shall operate without rubbing, liquid seals, or lubrication and shall be positively timed by a pair of accurately machined heat-treated alloy steel, spur tooth, timing gears. Timing gears shall be mounted on the impeller shafts on a tapered or machined fit and properly secured.
7. Each impeller/shaft shall be supported by double row ball or spherical roller bearings sized for a minimum of 50,000 hours of AFBMA B-10 life.
8. Provide a lip type oil seal at each bearing, designed to prevent lubricant from leaking into the airstream. Further provisions shall be made to vent the lubrication system to atmosphere to eliminate any possible carryover of lubricant into the air stream.
9. The timing gears and the bearings shall be splash oil lubricated from oil slingers mounted on the driving shaft and dipping in the oil sight glasses for oil level observation. Drive end bearings shall also be splash oil lubricated. Grease lubrication on drive end bearings is also acceptable.
10. The maximum gear tip speed and maximum gear diameter of the blowers shall be as specified in Paragraph 1.01 above for blowers which incorporate an integrally contained method of pre-pressurizing a trapped volume of air at a controlled rate prior to exposing it to discharge pressure, or other means of controlling pressure pulses and noise. Blowers not incorporating such features shall operate at a gear tip speed not to exceed

2/3 of the above specified speed. The above maximum gear tip speeds are intended to meet the noise limitations specified herein, however, additional noise attenuation equipment shall be furnished as required to limit noise levels to within those specified herein.

11. The blowers shall be designed to be capable of continuous operation at any speed between 100 percent design speed as required in Paragraph 1.06 above and 50 percent design speed. Speed reduction shall be by changing pulleys and belts as specified herein.
12. Each blower shall be driven by a constant speed, totally enclosed, fan cooled motor. Motor horsepower shall be as specified in Paragraph 1.01 above, however, the rated horsepower shall be such that the motors will not be overloaded nor the service factor reduced when the blowers are operated at any point on the design speed performance curve at the design differential pressure across the blower as specified in Paragraph 1.016 above. Horsepower requirements shall incorporate friction losses through the V-belt drive as well as the pressure required for the relief valve.
13. The motor shall be connected to the blower through a heavy duty V-belt drive, furnished complete with a guard in accordance with OSHA. The motor support shall incorporate means to easily adjust belt tension. The belt drive shall be arranged to allow substitution of pulleys and belts to change the speed of the blower. Furnish sufficient pulleys and belts to provide each blower with speeds to provide 50, 75 and 100 percent of full blower capacity as required by the design conditions of Paragraph 1.01 above.

B. Motors

1. Motor shall be suitable for 460 volt; 3-phase, 60 Hertz; totally enclosed, fan cooled; premium efficiency, NEMA B standards, space heaters, Class F insulation for 40 degrees C ambient temperature rise with 1.15 service factor. The motors shall not be overloaded beyond their nameplate rating, at the design condition, nor at any head in the operating curve as specified.
2. Bearing life: heavy-duty having an AFBMA B-10 life of 100,000 hours.
3. Provide V-belt drive assembly consisting of Sheaves, quick detachable bushings, V-belts, and sliding motor base. Provide drive assembly with a 14 service factor based on motor nameplate horsepower.
4. The drive shall be of the "stationary control" variable speed type that allows a speed change by means of an adjustment to the motor sheave when the drive is off. Size V-belt drives and sheaves so that the shut-off head at low speed is not lower than the design static head.
5. Motor shall have a cast iron frame and brackets. Motors with rolled steel frames are also acceptable.

6. Motors shall be as manufactured by U.S. Motors, Marathon, Reliance, Lincoln, Baldor, Siemens, or approved equal.

C. Sound Attenuating Enclosure

1. Each blower shall be provided with a sound attenuating enclosure equipped with ventilating fan and sufficient attenuating material to ensure that the system radiated noise does not exceed 80 dBA at full load.
2. The sound attenuating enclosures shall be constructed of galvanized steel or aluminum and backed with high density acoustical foam.
3. The sound attenuating enclosures shall be of have sufficient dimensions to house the blower/motor assembly and equipped with hinged doors so routine operation and maintenance will not be hindered.
4. The sound attenuating enclosures shall be Dresser Roots Attenu-Pac full enclosure or approved equal.

D. Accessories

1. Coupling guards - fabricated steel or ASHA approved fiberglass.
2. The base shall be built so that the blower and the motor are mounted to provide for horizontal tensioning of the drive. The base shall be plate steel with angle iron legs. The blower package supplier shall submit detailed drawing of the base for review by the engineer prior to manufacture. All welds are to be continuous and full penetration. Each leg shall be gusseted in two planes. Bases constructed of all angle iron are not acceptable.
2. Provide OSHA Style steel belt guard to enclose drive and belts. Design guard for easy removal. The guard shall be constructed to allow visual inspection of the drive system without removing the guard.
3. Provide each blower with a suitably sized air filter for the flow rates listed under design criteria. Inlet filters to be Model CCF Type as manufactured by Universal Silencer or equal.
4. Intake Silencer: Provide a heavy duty, all welded, noise attenuation unit constructed of carbon steel sheet and plate and featuring an acoustically treated outlet for pulse control. Provide silencer equal to Model RISY on silencers larger than 4" and RIS type on sizes 4" and smaller. Silencers shall be Universal Silencer or approved equal. Provide two (2), carbon steel, clamp type supports at each end of silencer for rigidly mounting silencer horizontally to the blower package base.
5. Discharge Silencer: Provide a heavy duty, all welded, noise attenuation unit constructed of carbon steel sheet and plate and featuring an acoustically treated outlet for pulse control. Provide silencer equal to

Universal Silencer Model SDY on sizes larger than 4". Provide two (2), carbon steel, clamp type supports at each end of silencer for rigidly mounting silencer horizontally to the blower package base. Fasteners shall be of plated steel.

6. Joints: Provide flanged sleeved cylindrical type, three ply bias fiberglass reinforced silicone rubber connectors for blower inlet and discharge connections. Furnish units which are capable of withstanding 25 psi and handle operating temperatures of 350 F. Expansion joints to be equivalent to XL-Fab Series 500; Mercer Rubber Co.; General Rubber Corp. or Metra Flex Co.
7. Pressure Relief Valve: Provide weight type relief valve with proper sizing and weights for setpoint pressure. Spring type valves are not acceptable.
8. Check Valves: Provide wafer type, cast iron body, aluminum internals for mounting on blower discharge piping. Provide valve equivalent to Techno Model 5118.
9. Discharge Butterfly Valve: Provide wafer type, resilient seated, lever operated, tight closing butterfly valve for positively isolating the blower from the manifold system. Furnish valve with cast iron body and disc of nodular iron; Stainless steel stem; Acetal Bushing; Buna-N seat; and 316 SS Torque plug Valve shall be Keystone model 2111785 or equivalent DeZurik, Crane or Pratt.

2.03 CONTROL AND INSTRUMENTATION

A. INSTRUMENTATION

1. Discharge Pressure Gauge: Provide a stem mounted discharge pressure gauge on the blower package to be equivalent to U.S. Gauge, McDaniel Instruments or approved equal.
 - a) Range; 0-15 psig.
 - b) Accuracy: 1 percent of full scale.
 - c) Dial: 2-1/2", 270 degree scale.
2. Each blower shall be provided with a Dwyer inlet manometer to measure the headloss across the inlet filter.
3. Discharge Temperature Gauge: Each blower shall be provided with a Trend discharge thermometer to measure the discharge air temperature of the blower.

B. CONTROL PANEL

1. One (1) control panel shall be provided to operate the two (2) new blowers and one (1) existing blower. The control panel shall be complete with

main circuit breaker, starters, motor breaker, phase monitor, surge protection, relays, timers, hand switches, alarm and status indicators, enclosures, alarm flasher and audible alarm. The alarm beacon shall be Edwards Model 57R-AY Xenon Strobe-Type or equal.

2. The enclosure shall be NEMA 4X, 316, 14 gauge stainless steel pad-lockable and a continuous piano hinged door.
3. The panel shall be suitable for 460-volt, 3-phase incoming power. Conduit entry to the panel shall be from the bottom only.
5. All relays shall be suitably rated and relays shall be provided with neon status lights and test buttons.
6. Changes to the field wiring requirements shall be fully coordinated by the contractor and all modifications to field wiring shown on the Drawings.
7. Finish:
 - a) Smoothly finish panel face openings for panel-mounted equipment. Cut with counterboring, and provide with trim strips as required to give a neat finished appearance.
 - b) Stainless steel surfaces shall not be painted. Finish interior steel back plate with two coats of baked enamel, white, ANSI No. 51.
8. Access and Identification:
 - a) Provide a continuous piano hinge door for ease of access on all control panels. Expose a minimum of 80 percent of the panel interior for door openings. Panel door openings shall be sealed and frilly gasketed. Provide print pockets on each door. Panel doors shall be equipped with quick-release latches as shown on the Drawings.
 - b) All components and terminals shall be accessible without removing other components except for covers.
 - c) Panels shall have conduit entry from the bottom only.
 - d) Provide laminated plastic nameplates for all front-face and interior panel-mounted controls to completely define their use.
 - e) Provide plastic, permanent identification tags and wire number tags for all internal components, wires, and terminals.
9. Corrosion Control: Protect all panels from internal corrosion by the use of corrosion - inhibiting vapor capsules, Hoffman, model A-HCI, or equal. Provide panels with combination drain/breathers, Crouse-Hinds model ECD18; or equal.
10. Construction: All panels shall be manufactured items, Hoffman Engineering Type A4S, or equal. Minimum metal thickness shall be 14-gauge. Provide stiffeners as required to prevent deflection under instrument loading and permit lifting without racking or distortion.

2.04 SPARE PARTS AND TOOLS

- A. The contractor shall furnish the following spare parts for each blower:
 - 1. One (1) set of seals and gaskets.
 - 2. One (1) set of lip seals.
 - 3. One (1) set of V-belts.
 - 4. Four (4) filter elements.
 - 5. One (1) Case of Blower Oil.
- B. All special tools required for normal operation and maintenance shall be furnished with the equipment.
- C. Additional spare parts shall be provided in accordance with manufacturer's recommendation.
- D. Spare parts shall be properly bound and labeled for easy identification without opening packaging and suitably protected for long-term storage.

2.05 SURFACE PREPARATION AND SHOP PAINTING

- A. All surfaces shall be prepared and shop primed as part of the work of this Section. Surface preparation and shop priming shall be as specified in Section 09900: Painting.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation.
- B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- C. Finished surfaces of all exposed blower openings shall be protected by wooden blanks, securely bolted thereto.
- D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- E. Each box or package shall be properly marked to show its net weight in addition to its contents.

3.02 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.
- C. Blower bases shall be rigidly and accurately anchored into position, and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the contractor. Anchor bolts shall be set by the contractor in accordance with the manufacturer's recommendations.

3.03 FIELD PAINTING

- A. Field painting is specified under Section 09905. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.04 STARTUP, INSPECTION AND TESTING

- A. Provide the services of a qualified factory certified representative for the required man-days as specified hereunder. The representative shall submit a copy of their factory training certificate to the engineer prior to start-up and training sessions. A man-day is defined as eight (8), on-site, working hours
- B. Initial Startup and Training: Upon notification of completion of aeration system by the contractor, provide a minimum of two (2) man days for blower equipment installation inspection, certification, start-up, training, and corrective adjustments.

3.05 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11361

COARSE BUBBLE AERATION DIFFUSER

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The contractor shall furnish completely engineered systems suitable for the operating conditions as outlined in these Specifications. Coarse bubble aeration equipment features such as drop leg size, air manifold sizes, air header sizes and spacing, air manifold and header supports and spacing, diffuser spacing, etc., required to comply with all requirements of this section shall be furnished complete.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Process Instrumentation and Controls - Products: Division 13.
 - 4. Electrical: Division 16.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer or Packager Qualifications: Supplier shall have experience in providing similar equipment, and shall show evidence of satisfactorily operating installations in the United States.
 - 2. Diffuser Packagers must be an Authorized Distributor or Representative of the diffuser being supplied.
 - 3. Diffuser supplier must be Factory Authorized to perform all phases of warranty work.
- B. Reference Standards:
 - 1. American Society for Testing Materials (ASTM)
 - a) ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.

- b) ASTM A530 - Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
 - c) ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
 - d) ASTM A743 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium- Nickel, Corrosion Resistant for General Application.
- 2. Compressed Air and Gas Institute (CAGI)
 - a) CAGI S5.1 - PNEUORP Test Code for the Measurement of Sound from Pneumatic Equipment.
 - 3. American Iron and Steel Institute (AISI)
 - 4. American Gear Manufacturers Association (AGMA)
 - 5. National Electrical Manufacturers Association (NEMA)
 - 6. American Bearing Manufacturers Association (ABMA)
 - 7. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.03 DEFINITIONS

- A. SCFM: Standard cubic feet per minute is air flow rate of 1 cubic foot per minute at 68 degrees F, 14.7 psia, and 36 percent relative humidity.
- B. SOTR: Standard oxygen transfer rate is the rate of oxygen transferred to tap water (pounds of oxygen per hour) at standard conditions of 20 degrees C, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).
- C. SOTE: Standard oxygen transfer efficiency is the fraction of oxygen transferred to tap water under standard conditions of 20 degrees C, 0.0 mg/l residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).
- D. Side Water Depth: Side Water depth is the interior dimensions from the structure base to the water surface.

1.04 SUBMITTALS

A. Shop drawings shall include the following information and shall be submitted in accordance with Engineer:

1. Complete description of the coarse bubble aeration equipment which shall include the drop pipes, connections to the air manifolds, air manifolds, air distribution headers, diffusers, supports, anchorage details, expansion joints, air manifold and header joints, gaskets, bolts, nuts and washers, and all materials used.
2. Detailed Drawings of the proposed coarse bubble aeration equipment layout for each basin, showing all air line sizes and lengths, distances between air distribution headers, and the location of all cast tee diffuser connections, diffusers, supports, and expansion joints (flex couplings).
3. Aeration system performance data including standard oxygen transfer efficiency.
4. Diffuser, diffuser connector, and system head loss curves covering the range of airflow rates specified under PERFORMANCE REQUIREMENTS.
5. Addresses and phone numbers of nearest manufacturer's representative.

1.05 OPERATION AND MAINTENANCE MANUAL

A. Installation, Operation and Maintenance Manual for the equipment specified herein shall contain as a minimum the following items:

1. Equipment Data Sheets
2. Installation instructions
3. Operation and maintenance instructions
 - a. Aeration system monitoring and maintenance
 - b. Startup and test operations
 - c. Normal operations
 - d. Shutdown procedures
 - e. Parts list
4. Aeration equipment drawings
5. Customer contact

PART 2 PRODUCTS

2.01 GENERAL

- A. The coarse bubble aeration equipment furnished under this section shall be the end products of one supplier/ manufacturer in order to achieve standardization for operation, maintenance, spare parts, and manufacturer's service.

2.02 MANUFACTURERS

- A. Acceptable manufacturers for coarse bubble aeration equipment for this project include Ashbrook Simon-Hartley, Sanitaire, Siemens Technologies, and ITT Industries.

2.03 OPERATION CONDITIONS

- A. The diffusers are to be used in the new 50,000-gallon aerobic sludge digester to provide complete mixing of the contents and sufficient oxygen for digestion.
- B. The aerobic sludge digester will be equipped with 12 evenly spaced diffusers, respectively to dispense 200 scfm air. Air will be supplied by blowers that are rated for delivering 200 scfm of air at 10 psig pressure.
- C. Aeration of the digesters may not be continuous; instead, the blowers will be operated whenever it is necessary. The diffusers shall be equipped with internal back flow prevention devices to prevent sludge from entering and/or clogging the diffusers.

2.04 EQUIPMENT DESCRIPTION

- A. General:
 - 1. The diffuser equipment system shall be of the fixed header, coarse bubble, and stainless steel type. The system shall be suitable for installation in the structures shown on the Drawings.
 - 2. The locations and size of the drop pipes to each diffuser grid are shown on the construction plans. The diffuser equipment shall include a vertical section of drop pipe, a flexible connection to the drop pipe, an air manifold, air headers, diffusers, supports, expansion joints, air manifold and header joints, gaskets, bolts, nuts, and washers.
 - 3. The design, fabrication, and installation of the diffuser equipment shall be such that, upon completion of installation, all diffusers are leveled to within $\pm 1/4$ inch of a common horizontal plane.

4. The coarse bubble aeration equipment shall be designed for easy installation and shall include provisions for level adjustment, rotational adjustment, and thermal expansion.
5. The entire system shall be designed to allow for expansion and contraction over a temperature range of 30 to 150 degrees F when installed.
6. All welded pipe supports and assemblies shall be shop fabricated from Type 304L stainless steel with a 2D finish conforming to AISI 304L and ASTM A240-78a. Unless specified otherwise, all non-welded pipe supports and pieces shall be shop fabricated from sheets and plates of 304 stainless steel conforming to AISI 304 and ASTM A240-78a.

B. Drop Pipe, Air Manifold, and Headers:

1. The installation contractor shall provide yard piping from the air supply main connection to the top of the digester sidewall. At that point, the manufacturer shall provide a drop pipe as shown on the plans to within 3 feet above the aeration basin floor. An expansion type band coupling shall be used to connect the drop pipe to the manifold piping.
2. The air manifolds shall be fabricated with flange connections to each air header. Fabricate manifolds in lengths conducive for shipping and installation. Manifolds shall be designed for long-term exposure to 150 degrees F mean-wall temperatures. The ends of the manifolds shall have welded end caps.
3. The air headers shall connect to the air manifold as indicated above. The air headers shall be perpendicular to the air manifold. Headers shall be fabricated in sections conducive to shipping and installation. Sections shall be joined with flanged joints of the face ring - follower flange type with thru bolts or expansion couplings where expansion/contraction capability is required.

C. Diffuser Assemblies:

1. The diffusers shall be of proven non-clog design. Each diffuser shall consist of a balancing orifice, an inverted air reservoir, air exit ports and an open bottom to allow solids drop out.
2. The diffusers shall provide full wide-band aeration, and release air uniformly along a minimum 2-foot band beyond each side of the header. They shall have a minimum air release perimeter of 48 inches with exit ports

discharging air into the liquid on horizontal planes at two levels.

3. A metallic balancing orifice in each diffuser shall provide the proper head loss to assure uniform distribution into the entire aeration system.
 4. The body of the diffuser shall be constructed of 304L stainless steel, minimum 20 gage, with a maximum carbon content of .030%. The body of the diffuser shall be a continuous seam welded to the end cap and end port. Spot welding is not acceptable. The end cap shall be cast stainless steel conforming to the requirements of ASTM 296, Grade CF3, and shall have a ¾" NPT male pipe connection equivalent to Schedule 80 pipe. End cap shall include an integral hex head fitting for tightening diffuser during installation.
 5. Provide diffusers as shown on drawings. The arrangement and spacing shall not exceed the dimensions shown.
 6. Diffuser shall have 1" wide-open slot along entire length of diffuser to allow solids drop out.
 7. Diffusers shall consist of a balancing nozzle with orifice insert if required, an inverted air reservoir, air exit ports and cast end cap at inlet end.
 - a. Cast the diffuser inlet end cap with an alloy equivalent to 304L stainless steel.
 - b. Provide the inlet end cap with a Schedule 80, ¾" NPT male connection and integral hex head nut.
 - c. Fabricate the diffuser bodies and outboard end cap from 304L stainless steel.
 - 3 Use full penetration weld to connect diffuser body to cast end cap.
 8. Coarse Bubble Diffuser Check Valve: The diffuser shall have an integral check valve to prevent solids and fluids from entering the pipe work. The check valve material shall be EPDM rubber, which is resistant to wastewater fluids. The check valve shall be mounted inside the cast end-cap of the stainless steel diffuser and seal against air inlet upon shutdown. The EPDM flapper shall be attached to the cast housing using stainless steel hardware.
- D. Duplex Diffuser Connectors: The connector shall be factory welded to the bottom centerline of the air header and located in accordance with the drawings using V-groove full penetration welds. This connection shall be capable of withstanding a horizontal or vertical moment of 1,000 inch-pounds without exceeding the 24000-psi

design stress in any part of the header wall or connector. The Manufacturer shall provide stress calculations certified by an independent, registered Professional Engineer, which demonstrate the capability of the connector.

E. Supports:

1. All supports shall be fabricated of type 304 stainless steel for non-welded supports and 304L for welded supports. The supports shall be designed to provide $\pm\frac{1}{2}$ inch lateral and ± 2 inch vertical adjustment of the header. Adjustment shall be continuous and possible without removing the air piping from the support. All pipe ends and joints shall be provided with a pipe support. Support height shall be sufficient to provide the diffuser elevation shown on the construction plans.
2. Air manifold piping shall have a maximum spacing between supports of 16 feet. Manifold supports shall be attached to the tank floor with stainless steel anchor bolts and shall be designed for ten (10) times the normal uplift force.
3. Diffuser headers shall have a maximum spacing between supports of 16 feet. Header supports, shall allow longitudinal movement of the header section to prevent stress buildup in the header due to thermal expansion/contraction forces. Maximum horizontal thrust of 20 pounds or less shall initiate movement of the header relative to the mechanism under full buoyant up-lift load.
4. Anchor bolts for fastening the supports to the aeration basin concrete slab and walls shall be Type 304 stainless steel. Minimum anchor bolt diameter to be used is $\frac{3}{8}$ inch. Supports shall be located such that concrete anchors are not installed within 6 inches of any concrete expansion joint.

F. Header Joints:

1. Connections between sections of the air distribution header shall be made using flanged joints of the face ring - follower flange type or with expansion couplings where expansion/contraction capability is required. These joints shall be designed so that individual header sections can be rotated independently of adjacent header sections for alignment purposes.
2. Expansion joints shall be capable of handling the expansion and contraction of the air distribution system over a temperature range of 100 degrees F.

G. Miscellaneous: Nuts, bolts, washers, and other non-welded parts directly exposed to the wastewater shall be type 304 or 18-8 stainless steel. Threaded assemblies shall

be chemically treated or lubricated prior to assembling to prevent galling.

2.05 SPARE PARTS

- A. The following spare parts shall be furnished and shall be suitably marked and boxed for shipment and storage:
Item - Diffuser Assemblies (ready for installation on air header)
Quantity = 4

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The coarse bubble aeration equipment shall be packaged and shipped by the Manufacturer ready for unloading, storage, and installation by the Installation Contractor. The Owner will provide a suitable storage space for the aeration equipment.
- B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- C. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
- D. Each box or package shall be properly marked to show its net weight in addition to its contents.

3.02 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.
- C. All necessary foundation bolts, plates, nuts, and washers shall be furnished and installed by the contractor in accordance with the manufacturer's recommendations.
- D. A technically qualified Manufacturer's representative for the equipment specified herein shall be present at the job site and/or office designated by the Owner for the minimum person-days for the services listed below, travel time excluded:

1. One (1) person-day for installation, assistance, inspection, and certification of the installation.
2. One (1) person-day for startup, functional testing, and training of the Owner's personnel.

3.03 STARTUP, INSPECTION AND TESTING

- A. After installation of the coarse bubble aeration equipment is complete, witness functional testing conducted by the Installation Contractor to check for leaks, uniformity of air release, and verification of level installation. Functional testing shall be performed with clean water at a depth over the diffusers as recommended by the aeration system Manufacturer. The Installation Contractor shall repair any leaks in the headers, diffusers, pipes, or any part of the system. The test shall be repeated until the installation is void of air leaks.
- B. A Manufacturer's certificate of satisfactory installation is required for work under this section.

3.04 WARRANTY

- A. The Manufacturer shall warrant all parts, including diffuser assemblies, distribution piping, and supports, free from defective material and workmanship for a period of 1 year after shipment. Warranty shall be limited to parts and labor for all necessary repairs within the warranty period provided repairs are made within 60 days after the Manufacturer is notified of a defect.

END OF SECTION

SECTION 11377

SEQUENTIAL BATCH REACTOR EQUIPMENT

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The equipment furnished under this section shall be a complete Sequential Batch Reactor (SBR) treatment system. The sequential batch reactor manufacturer shall be responsible for overall supply and quality of all the items specified herein and shown on the drawings. The system shall be a two (2) basin fill and draw activated sludge process. Each of the basins shall, in turn, within a discrete time period, be filled with screened and degritted raw wastewater and aerated in a batch mode. After aeration, the mixed liquor shall be allowed to settle. The treated supernatant shall then be withdrawn from the basin utilizing a floating effluent decanter mechanism, and discharged. The system shall consist of jet aeration headers with a flush-out system, motive liquid pumps, sludge wasting system, blowers, floating effluent decanters, automatic influent valves, automatic decant valves, automatic air control valves, Influent Distribution/Sludge Collection manifolds, preprogrammed process control panel, and in-basin liquid piping, air piping, and supports.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Piping, Valve, and Equipment Identification System: Section 09905
 - 4. Piping, Fittings, Valves, and Accessories: Section 15050
 - 5. Process Instrumentation and Controls - Products: Division 13.
 - 6. Electrical: Division 16.
- C. The sequence batch reactor manufacturer shall be responsible for testing, start-up, troubleshoot, and personnel training of the sequence batch reactor system specified herein and shown on the drawings.
- D. The Contractor shall install the sequence batch reactor system specified herein and shown on the drawings.

1.03 QUALITY ASSURANCE

- A. Qualifications:

1. The equipment specified in this section shall be supplied by only those manufactures that are fully experienced, reputable, qualified and regularly engaged in the manufacture of the components to be furnished. The contractor shall not utilize individually purchased components and controls. The complete sequence batch reactor system including all components, controls and services shall be furnished by a single supplier who shall be responsible for the operation of the complete system. Equipment manufacturers, except those listed, that desire to supply equipment specified in this section must submit a qualification package for approval by the Engineer no later than three (3) weeks prior to the bid date. The Engineer will issue an addendum listing the acceptable suppliers prior to the bid date. Qualification packages received after the submittal deadline will not be considered. The qualification package must include as a minimum:
 - a. Design calculations and a complete description of the proposed operating strategy, including operating cycle descriptions for minimum, design, peak, and peak instantaneous flows.
 - b. Complete specifications describing the equipment proposed.
 - c. Drawings, diagrams, and catalog cuts, for all mechanical and electrical equipment which show all process, structural, or ancillary equipment modifications required to comply with the full intent of the job specifications.
 - d. A complete list of all exceptions to the specification, for both mechanical and process features.
 - e. Current SBR installation list, with names of contacts and phone numbers.
 - f. Certification of compliance with the materials of construction specified.
 - g. Listing of any additional utilities required other than those specified.
 - h. Maintenance schedule, method of maintenance performance, and life expectancy of all equipment when applied as intended in the specifications.
 - i. List of all recommended spare parts.
2. The SBR shall be a system as manufactured by Siemens Water Technologies or equivalent.

1.4 SUBMITTALS

- A. See Section 01340, Submittals, for submittal requirements.
- B. Provide product Information and descriptive literatures for the following components:
 - 1. Jet aeration headers.
 - 2. Flush out system.
 - 3. Motive liquid pumps.
 - 4. Sludge wasting pumps.
 - 5. Blowers.
 - 6. Floating effluent dancanters.
 - 7. Automatic influent valves.
 - 8. Automatic decant valves.
 - 9. Automatic air control valves.
 - 10. Influent distribution/sludge collection manifolds.
 - 11. Pre-programmed process control panel.
 - 12. In-basin liquid piping.
 - 13. Air piping.
 - 14. Supports.
- C. Submit following shop drawings:
 - 1. Design notes and calculations.
 - 2. Certified drawings.
 - 3. Performance curves.
 - 4. Foundation and installation plans.
 - 5. Wiring and piping schematics.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The SBR aeration system shall be designed to transfer 85 lbs. of standard oxygen per hour per basin. The operating strategy shall provide for the following discrete periods in each cycle for all flow rates:
 - 1. ANOXIC FILL. At design flow, a minimum of 30% of the total Fill period for each reactor shall be anoxic. The aeration system is not operated as the reactor is charged with incoming wastewater.
 - 2. AERATED FILL. The aeration system is operated during the latter stage of the fill cycle, allowing biodegradation to begin.
 - 3. REACT. Influent flow is diverted to the next basin in sequence; the aeration system is operated to complete biodegradation. A

minimum of 30% of the total aeration time in any cycle shall be React.

4. QUIESCENT SETTLE. Aeration is terminated, and the biomass is allowed to settle. The Settle period shall be a minimum of 45 minutes, and be accomplished under perfect quiescent conditions; no flow shall enter, or be withdrawn from, a reactor during the Settle period.
5. DECANT. Treated effluent is withdrawn from the upper portion of the reactor by a floating effluent decanter.

- B. To insure consistent microorganism selection, reactor basins shall be intermittently fed, and operate in a "complete mix" mode. Processes utilizing continuously fed, or "plug flow" reactors will not be acceptable. A preprogrammed process controller shall control the process and incorporate each of the above periods in each cycle, under all flow conditions. Strategies that eliminate Anoxic Fill and/or React at peak flow rates will not be acceptable. The operating strategy shall automatically increase the percentage of total aeration (Aerated Fill plus React) in each cycle, directly proportional to total batch size. Systems utilizing float control, or level set points to increase aeration in "steps" will not be acceptable. Minimum total aeration percentages shall be:

Minimum Flow	17.5% of each cycle
Average Flow	37.5% of each cycle
Peak Flow	50% of each cycle

- C. The SBR system shall be furnished in accordance with the following specifications and as shown on the plans. The valves, equipment, materials of construction, and controls specified under this section supersede any other specifications located elsewhere in the contract documents.

2.02 SEQUENCE BATCH REACTOR (SBR) SYSTEM

- A. The SBR system shall be designed based on the following site and raw wastewater characteristics:

Average Flow	0.16 MGD
Peak Instantaneous Flow	0.48 MGD
Influent BOD5 at Avg. Flow	260 mg/l
Effluent BOD5	5 mg/l (Required)
Influent Suspended Solids	250 mg/l
Effluent Suspended Solids	5 mg/l (Required)
Influent TKN	95 mg/l
Effluent TN	3.0 mg/l (Required)
Effluent NH3	1.0 mg/l (Required)
Influent Phosphorus	7 mg/l
Effluent Phosphorus	1.0 mg/l (Required)

Site elevation, Ft. MSL	80 ft.
Wastewater temperature (Min.)	15 °C
Normal Max. SWD	18 ft.
Normal Min. SWD	15.5 ft.

2.02 JET AEREATION HEADER

- A. Two (2) identical aeration headers shall be provided. Each jet aeration header shall be comprised of a liquid duct, an air duct, and a minimum of nine (9) jet aerator assemblies. Each header shall be constructed such that the liquid duct, air duct, and jet aerator assemblies comprise one self-contained unit, and shall be shipped as such; complete and ready for installation. Headers in excess of forty (40) feet in length may be shipped in sections. A maximum of one "field joint" may be required for each forty (40) feet of header length.
- B. The liquid duct shall be a cylindrical member having a plurality of liquid nozzle entry orifices which are longitudinally spaced along its perimeter, and aligned on a common horizontal plane. The inner surface of the liquid duct shall be smooth and free of protrusions which might collect stringy material.
- C. The air duct shall be a cylindrical member which is parallel to and above the liquid duct. The air duct shall be jointed to, and supported by, the air manifolds, and additional support points as necessary. The air duct shall have a plurality of air manifold entry orifices longitudinally spaced along its perimeter, in corresponding number to, and in vertical alignment with the liquid nozzle entry orifices of the liquid duct. The provision of a separate air entry manifold with a fixed orifice for each jet assembly shall insure uniform air distribution.
- D. The liquid and air ducts shall be machine filament wound fiberglass reinforced thermosetting resin pipe. Liquid and air ducts shall be fabricated in strict accordance with ASTM Specification D-2996-01. Hand filament wound FRP piping (fabricated in accordance with NBS specifications), PVC or other thermoplastics are not acceptable. Minimum acceptable pipe wall thickness (including corrosion liner) shall be per the following table:

Diameter	Wall Thickness
4"	0.104
6"	0.146
8"	0.146
10"	0.188
12"	0.188
14"	0.230
16"	0.272
18"	0.272

20"	0.314
24"	0.356
30"	0.440

- E. The minimum pressure rating of the aeration header shall be 75 PSI. Minimum pressure rating is an internal rating and must have a minimum 5:1 safety factor against short term burst hoop tensile strength and 1.8:1 safety factor against long term hydrostatic design basis. If the manufacturer proposes a system that utilizes flush-out, the header shall be designed for an appropriate external vacuum rating for the service conditions and shall have a minimum of 3:1 safety factor against hoop tensile strength. Manufacturer shall provide calculations and structural wall thickness in regard to the intended service conditions.
- F. Each jet aerator assembly shall consist of an inner liquid nozzle, and an outer air/liquid delivery nozzle. The inner and outer nozzles shall be aligned on a common centerline, joined together, and laminated to form a single unit. The jet aerator assembly shall be joined to the liquid duct and the air manifold and laminated for strength to form a single integrated unit. Systems with non-integral jets will not be accepted. The matting surface of the jet aerator assembly shall match the contour of the liquid duct and be stepped to match the liquid nozzle entry orifices of the liquid duct to insure proper alignment, and provide a smooth contoured liquid flow path. No portion of the liquid nozzle or aerator assembly shall protrude into the liquid duct.
- G. In order to reduce the plugging potential, the liquid nozzles shall be of constantly reducing cross-sectional area in the direction of flow. There shall be no parallel section in the liquid flow path between the liquid duct and the exit orifice of the liquid nozzle. The distance between the exit orifice of the inner nozzle and the exit orifice of the outer nozzle shall be such that substantial air entrapment by the liquid stream occurs prior to its discharge from the outer nozzle.
- H. The outer nozzle exit orifice shall have a cross-sectional area of at least 2.5 times that of the inner nozzle exit orifice. The outer nozzle shall be of constantly reducing cross-sectional area in the direction of flow with an included angle of at least 20° for at least nine inches along the flow path to increase the velocity of the air/liquid stream.
- I. Both inner and outer nozzles shall be of non-clog design, free from all protrusions which might collect stringy material, and be capable of passing a 1½" spherical solid. Inner and outer nozzles shall be fabricated of isophthalic, corrosion resistant laminating resin, reinforced with glass fibers, and a surfacing material of a commercial grade chemical-resistant glass having a coupling agent. The interior of each air and liquid nozzle shall contain a "coabrasion" liner to specifically achieve optimum chemical and abrasion resistance. Each nozzle shall contain a specific liner separate from the structural fiberglass wall of the nozzle. The liner shall be constructed of a glass laminate utilizing a minimum of 2 layers of 0.010 inch

synthetic, apertured “Nexus” or “C glass” veil. The interior liner shall be a resin-rich surface layer containing no more than 20% by weight of either synthetic or “C-glass” veil, and shall be free from cracks and crazing. Exterior of outer nozzles shall be protected with a separately cured, pigmented, paraffinated gel coat to protect from UV degradation. All construction shall be in accordance with the American Voluntary Standard PS 15-69, or the Canadian Voluntary Standard 41 GP-92.

- J. The air manifolds shall be enclosed conduits which convey the compressed air from the air duct to the jet aerator assembly. The air manifolds shall be fabricated of an isophthalic, corrosion resistant laminating resin, reinforced with glass fibers, and a surfacing material of commercial grade chemical-resistant glass having a coupling agent. Air manifolds shall be fabricated in accordance with NBS Specification PS 15-69.

2.03 INFLUENT DISTRIBUTION/SLUDGE COLLECTION (ID/SC) MANIFOLD

- A. An Influent Distribution/Sludge Collection Manifold shall be provided for each reactor basin. Manifolds shall be designed and sized to distribute the influent flow evenly across the reactor floor during Anoxic Fill, and collect settled sludge through the same manifold during the sludge waste operation. Manifolds shall be sized such that the maximum exit velocity of the influent at peak flow conditions is 0.5 feet per second.
- B. ID/SC manifolds shall be constructed of fiberglass reinforced plastic meeting the Voluntary Product Standard NBS 15-69, or Schedule 40 PVC.
- C. All necessary supports for the ID/SC manifold shall be provided and shall be fabricated of Type 304 stainless steel.

2.04 FLUSH-OUT/WASTE SLUDGE SYSTEM

- A. A combined positive flush-out system and waste sludge system which is composed of the jet aeration recirculation pump, out-of-basin crossover pipe configuration, and valve arrangement, shall be utilized. The flush-out system shall draw liquid only in a reverse direction through the liquid nozzles at a velocity of at least 10 feet per second. The flush-out operation shall be accomplished by closing the pump suction and discharge valves, and opening two crossover valves, thereby reversing liquid flow through the aeration jets, and discharging out the ID/SC manifold. No air shall pass through the liquid nozzles during the flush-out operation. The piping and valve network shall also provide for the capability of wasting sludge with the same recirculation pump and the ID/SC manifold. The aeration system manufacturer shall provide all necessary valves for the flush-out and waste sludge system. Butterfly valves are not acceptable. All out-of-basin piping, including pump suction pipe, discharge pipe, flush-out crossover pipe, air release valve, and waste sludge line with

supports and hardware necessary to complete the system shall be furnished by the contractor.

2.05 AIR PIPING

- A. In-basin air drop pipe shall be provided as a part of the aeration system. The piping shall be of adequate length and diameter to transport the compressed air from a point at the top of the basin wall, as shown on the plans, to the air duct of the aeration header. A flanged connection shall be furnished for connection to the out-of-basin air piping, provided by others. Hardware required to complete this flanged connection will be supplied by the contractor. In-basin air piping shall be machine filament wound, fiberglass reinforced thermosetting resin pipe fabricated in strict accordance with ASTM Specifications D-2996-01.

2.06 LIQUID PIPING

- A. In-basin liquid piping shall be provided as a part of the aeration system. The piping shall be of adequate length and diameter to transport the motive liquid from the pump discharge wall sleeve flange, to the aeration header. A flanged connection shall be provided at this interface point, and hardware to complete this flanged connection shall be supplied by the contractor. In-basin liquid piping shall be machine filament wound, fiberglass reinforced thermosetting resin pipe fabricated in strict accordance with ASTM Specification D-2996-01.

2.07 SUPPORTS

- A. All necessary supports for the aeration headers, in-basin liquid and air piping, ID/SC manifolds, and decanters shall be provided as a part of the system. Header supports shall be of the "H" type, having two support legs with a minimum of six anchor bolts. The supports shall be fabricated of Type 304 stainless steel.
- B. The supports shall consist of a contoured saddle and a supporting base. The base shall be anchored with anchor bolts and grouted in place, if necessary. The saddle shall be provided with a Buna-N rubber pad to avoid abrasion. A contoured clamp with an accompanying Buna-N rubber pad shall hold the piping to the saddle. Fastening hardware shall be Type 18-8 stainless steel.

2.08 ANCHOR BOLTS

- A. Anchor bolts of sufficient size and quantity shall be provided for mounting of all manufacturer supplied SBR equipment and piping in the basin. The anchor bolts shall be two part stud and acrylic resin system. The anchor system shall consist of acrylic resin and hardener contained in a dual cartridge with static dispensing nozzle. Each anchor bolt shall be supplied with a stud, flat-washer, lock-washer & nut of Type 18-8 stainless steel.

2.09 SBR PROCESS PUMPS AND BLOWER

- A. Blower shall be 230/430 V/3Ø/60 Hz and made to deliver 360 scfm at 10 psig. Process blowers shall include angle frame table top, base, silencers, air filter, v-belt drive with guard, 20 HP electric motor, changeable pulleys, starter panel with NEMA 4x enclosure, motor starter, blower run lights, hand-off-auto switch, surge suppressor, and terminal strip for auto control.
- B. Circulation pumps shall be 230/430 V/3Ø/60 Hz and made to deliver 600 gpm at 22 feet TDH. The pumps shall be powered by 5 HP electric motors and shall be equipped with starter panel with NEMA 4x enclosure, motor starter, pump run lights, hand-off-auto switch, surge suppressor, and terminal strip for auto control.

2.10 DECANTER

- A. There shall be a total of two (2) floating decanters to extract final effluent from the reactor basins. Fixed decanters will not be acceptable. Each decanter shall consist of an effluent withdrawal manifold, having several solids excluding orifice assemblies, with a single foam filled float, and shall be capable of intermittent operation. The decanter assembly shall be constructed of machine filament wound, fiberglass reinforced thermosetting resin pipe fabricated in strict accordance with ASTM Specification D-2996-01. The decanter shall be designed to be capable of withdrawing the effluent at an average rate of 685 gallons per minute. Decanters must employ positive mechanical type seals for excluding solids from the draw tube. Decanters having an open conduit or any open areas exposed to the mixed liquor during react, or that require additional equipment or motors for pressurization, wear movement, or complete removal out of the liquid, are unacceptable.
- B. The draw tube, containing the orifices for removal of effluent shall be integrally attached to the foam filled float such that the float remains level throughout the full range of operation, and to maintain submergence of the orifices of the main body. The main body will be connected to the effluent piping by means of a 8" flanged stub. The effluent pipe shall include a "knee" joint to allow vertical movement. The "knee" joint shall be wire reinforced rubber hose with a flange at each end, and include a support mechanism that allows vertical articulation, but precludes lateral or twisting movement. Hose shall be Type "E" suitable for abrasive materials, and shall be rated at 30 inches mercury vacuum and 15 PSI working pressure. The effluent pipe shall be provided with a flanged connection for mounting the decanter system to the installed pipe through the basin wall. Flange connection shall be in accordance with ANSI standard 150 pound bolt pattern. Hardware at this flanged connection interface shall be furnished by the contractor.
- C. The solids excluding orifice assemblies shall be field replaceable, and attached to the effluent withdrawal manifold. The assembly shall consist of a 304 stainless steel

orifice plate, 302 stainless steel constant compression spring, 304 stainless steel spring housing, a PVC drive rod, a hard rubber plug, and a 304 stainless steel support/alignment cage assembly. The solids excluding orifice assemblies shall be factor aligned and welded to form a complete assembly. The drive rod shall seat against the spring, in the spring housing, and be attached by a threaded rod to the sealing plug. The hydraulic differential provided shall be a minimum of 3.5 feet in addition to the pipe friction losses determined as the differential head, under flowing conditions, between reactor bottom water level and top water level at the downstream discharge. The point of decanted effluent discharge downstream of the SBR shall be either constantly submerged, or designed with a water trap.

- D. All necessary supports for the decanter mechanism shall be provided. The supports will be located on the basin floor, and will support the decanter mechanism when the basin is dewatered. The supports shall be fabricated of Type 304 stainless steel. The supports shall consist of a support plate welded to a supporting base. The base shall be anchored with anchor bolts and grouted in place if necessary. Fastening hardware shall be Type 18-8 stainless steel.

2.11 VALVES AND VALVE ACTUATORS

A. GENERAL

Valves shall be furnished per the following schedule:

- Two (2) 6" automatic plug valves (influent control).
- Two (2) 8" automatic butterfly valves (effluent control).
- Two (2) 6" automatic butterfly valves (air control).
- Two (2) 12" automatic plug valves (pump discharge).
- Two (2) 12" manual plug valves (pump suction).
- Four (4) 8" manual plug valves (vacflush header cleaning system).
- Two (2) 6" automatic plug valves (waste sludge).

This valve specification shall take precedence over any other valve specifications in the contract documents.

B. ECCENTRIC PLUG VALVES

1. All eccentric plug valves shall be permanently lubricated and shall be of the tight-closing, rubber seat type. Valves shall be suitable for sewage and wastewater application, shall have throttling capability, and shall be rated 150 lb. WOG. Valve bodies shall be cast iron. Valve plugs shall be balanced type and constructed of either cast iron or ductile iron. Passage size shall be a minimum of 80% of the full port area for valves through 20" size and a minimum of 70% of the full port area for valves 24" and larger. Upper and lower bearing shall be either stainless steel or bronze and permanently lubricated. Packing shall be U-cup, O-ring or V-type, self adjusting, and wear

compensating. Packing shall be replaceable without removing the valve bonnet or plug. All valves shall be leak tested to their full rating prior to shipment. Manual plug valves shall have worm gear actuators with handwheels. Actuators shall be sized for 50 PSI shut off pressure against the face of the plug. Gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant. Seals shall be provided on all shafts to prevent entry of dirt and water into the actuator.

C. BUTTERFLY VALVES

1. Valves shall be specifically designed for air service and clean water service. All valves shall have a maximum of 50 PSI pressure rating and valves for air service shall have a temperature rating of 250°F. Valves shall be either wafer or lug design with cast iron body. Valve disc shall have an uninterrupted 360° seating surface and shall be aluminum bronze, ductile or cast iron with an appropriately suitable edging. Shafts shall be one piece and shall be of high-strength carbon steel with phosphate coating, or stainless steel. Shaft bearings shall be self-lubricating, and corrosion resistant. Packing materials shall be either adjustable or self-adjustable and shall be suitable for the intended temperature and service conditions. Manual butterfly valves shall be provided with lever actuators or geared actuators with handwheels, and shall be sized appropriately for the service conditions and specific application. Lever operated valves shall latch in the open, closed, or several intermediate positions.

D. QUARTER TURN ACTUATORS

1. The electric motor operator shall consist of motor, reduction gearing, position limit switches and torque limiting switches mounted in a NEMA IV housing. Actuators shall be rated for 50 PSI working pressure. Local open / close pushbutton stations are not required on the actuators. Open / close switches shall be provided for hand operation of valves at the SBR control panel.
2. The motor shall be of the high torque type, designed for continuous duty rating. Motors and wiring shall have Class "B" or better insulation. Overload protection shall be provided by auto-reset thermal trip circuit breakers embedded in the motor windings. All motor leads shall be terminated at an internal terminal strip. The motor will operate on an AC power supply of 120 volts, single phase, 60 cycle.. Actuators shall be provided with integral motor starters (if required). Power for all automatic valves shall be the responsibility of the installing contractor. Valve power shall not be provided through the SBR control panel.
3. The integral self-locking power gearing shall be compound epicyclic or combined helical and worm gear type only. Motor breakers are unacceptable. Gearing shall be grease or oil lubricated with high speed parts running on

anti-friction bearings. Motor shall operate from open to full close in 60 seconds. Disassembly of gears shall not be required to remove the motor.

4. The handwheel shall not rotate during electrical operation. When the unit is being operated manually, it shall automatically return to electric operation when the handwheel is released. The transfer from electrical operation to manual operation shall be accomplished by a declutching mechanism, which will disengage the motor mechanically. The unit shall be capable of being clutched or declutched while the motor is energized with no damage to the clutch or gear mechanism. Clockwise rotation of the handwheel shall close the valve. If the motor is energized during manual operation, the unit shall remain in manual mode without endangering personnel operating the unit.
5. Failure of the motor or motor gearing shall not hinder manual operation. Limit switches set at the open and close positions shall be provided.
6. A double-acting torque limiting switch shall be provided, which is responsive to the mechanical torque developed by seating or an obstruction.

2.12 SUBMERSIBLE PRESSURE TRANSDUCER

- A. Submersible pressure transducers shall be specially designed for direct submergence in wastewater. Units shall be constructed of stainless steel.
- B. Standard transducer shall have an operating range of zero to 34.6 ft. of water with a temperature range of -40 to 80°C, with compensated range of zero to 50°C. Accuracy of measurement shall be $\pm 0.5\%$ including linearity, hysteresis, and repeatability.
- C. Transducer output shall be a 4 to 20 mA signal. Electrical connection shall be to an attached three wire, 20 gauge polyethylene shielded cable.
- D. Transducer shall be suspended within a 4" diameter stilling well attached to the basin wall. The stilling well shall contain equalization ports spaced as required. The stilling well shall be continuous from a point six inches above the floor to a point six inches below the top of the wall.

2.13 PROCESS CONTROL PANEL

- A. Panels designed for indoor use shall utilize NEMA 12 enclosures. Finish paint to be two part high build epoxy. All selector switches and push buttons shall be industrial heavy duty oil tight. Enclosures shall be by Hoffman. The panel shall be capable of controlling and monitoring SBR functions and activities. The control panel shall as a minimum be capable of controlling:

1. SBR blowers.

2. SBR recirculation pumps.
3. Automatic influent, decant, and air control valves.
4. SBR effluent pumps in equalization tank.

2.14 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. GENERAL

1. A nationally recognized brand of industrial rated hardware shall be implemented for execution of SBR process software. Programmable controllers with CMOS RAM and EPROM memory cartridges shall be utilized. Coprocessors shall be utilized to off-load primary CPU for high level functions. All programs shall be permanently stored on EPROM memory chips. Local I/O expansion, remote I/O and peer CPU I/O shall be available within the same family. Multiple serial ports shall be available with communications (RS232 and RS422). Real time clock with day of week, and operator interface ports shall be standard features.

B. FLOW PROPORTIONAL SOFTWARE

1. Flow and time adaptive algorithms are utilized to make the treatment step adjustments fully automatic. Software shall be configured for as many SBR tanks as will operate in sequence. Provisions for detection of pump, blower and valve failure shall be provided. SBR tank failure based upon equipment failure shall be selectable on an equipment item list as well as on a tank-by-tank basis. Tank failure shall occur 5 minutes after equipment failure allowing the operators time to respond. SBR operation will resume unchanged following short power outages. Software will recognize long power outages, and initiate plant restart based upon length of outage and tank levels upon power restoration. Submersible pressure transducers, high level float switch, stilling well and mounting hardware for each tank shall be provided.

C. I/O CARDS

1. Input and output cards shall have removable wiring terminal strips. All wiring to module will terminate on terminal strip. Individual lamps for each input or output shall be provided on each card. Analog input and output cards shall have a minimum resolution of 12 bits.

D. OPERATOR INTERFACE

1. All setpoints and progress monitoring shall be accessible with the standard panel mounted operator interface. Interface shall consist of a display and membrane keypad, and software for communications to the PLC hardware

system. Display shall consist of a 20 character by 4 line vacuum fluorescent display. Memory programming shall be in a "menu" structure, allowing easy access to all points. Function keys shall be programmed for one key access to most commonly used data. Direct access to any setpoint shall be available. Individual data points as well as group data points shall be password protected as directed by the owner. All setpoints shall be described with text that explains specifically what the setpoint or monitoring point is. Operator interfaces that refer to PLC memory register locations are unacceptable. All numeric values shall be represented with floating point decimal in correct position, sign (for negative numbers), and annotated with units designation (i.e. feet, gpm, minutes). Setpoints shall be protected by low and high limits. All operator interface programming and configuration data shall be permanently stored in EPROM.

2. Control circuits shall allow for manual override of PLC system by selector switches on the panel front. Panel mounted indicator lamps for operation and failure of equipment shall be provided. Overload cutout and seal failure indication shall be provided for submersible pumps. Float switch detection of high level in each SBR shall override the transducer level signal to initiate an emergency decant. All failure lamps and alarm horn operations shall annunciate following I.S.A. sequence "A".

E. PRINTER

1. A data logging printer and software shall be provided. A steel print shelf designed for the printer shall be mounted to the right side of the control enclosure. The printer shelf shall be painted to match the controls enclosure. The printer shall document treatment step changes, time of change, length of treatment step, tank levels and flow rate at the time of change. Printer software shall document time of alarms and clearing of same. Printer shall operate at 300 characters per second, use a bottom feed paper path, and have a 23K-byte print buffer.

F. WIRING

1. All wiring to module will terminate on terminal strip. Panel wiring shall be:
 - Type MTW, sized per applicable codes.
 - 16 gauge minimum wire size for 120 VAC.
 - 20 gauge minimum wire size for 24 VDC.

Wiring shall be color coded as follows:

1. 120 VAC (unswitched).....black
2. Neutral.....white
3. Ground.....green

- 4. +24 V.D.C. blue
- 5. 24 V (return) red

2.15 D/O CONTROL

- A. A dissolved oxygen control system shall be provided by the SBR system manufacturer. The D.O. control system shall utilize operator adjustable D.O. setpoints to control blower on / off operation during the aeration period. One (1) D.O. probe with mounting bracket and one (1) analyzer shall be provided for each SBR basin. Probes shall be continuous reading type utilizing luminescent sensor technology. Probes shall be Hach LDO with Hach SC100 analyzer, or equal.

2.16 FIELD SERVICE

- A. The SBR system manufacturer shall provide an installation dry check consisting of one trip for three (3) man-days; equipment / controls start-up, operator instruction and training service consisting of two trips for six (6) man-days; and follow-up operator training, within three months of initial start-up, consisting of one trip and three (3) man-days. All service shall be carried out by a qualified service engineer. Written service reports of each service phase shall be distributed to the Engineer and Owner.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery shall be by the manufacturer's own personnel and delivery vehicle. The delivery person shall be capable of giving the contractor guidance on the installation of the system. Delivery by independent freight carrier is unacceptable.

3.01 INSTALLATION

- A. Install the sequential batch reactor equipment as indicated on the drawings and specified and in compliance with the manufacturer's instructions.

3.02 INSPECTION AND TESTING

- A. Upon completion of installation, a full operating test shall be performed in the presence of the Engineer and a qualified direct company employed manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted.
- B. The manufacturer shall provide the following services specified:

- 1. Mechanical and Process Start-Up Services

- a. One (1) session of mechanical and process start-up services.

2. Operator Training Services

- a. One (1) session of instructions to operating personnel on the operation and maintenance of the system.

3.03 OPERATION & MAINTENANCE MANUALS AND PRODUCTION RECORDS

- A. Operating and maintenance manuals prepared specifically for this project shall be provided. Manuals shall include all procedures, drawings, parts lists, etc. required to instruct personnel unfamiliar with such equipment. Operation and maintenance manuals shall be prepared in accordance with all specifications of this project. Complete operating and maintenance manuals shall be provided in PDF electronic format with bookmarks and index for easy navigation.

3.04 WARRANTY

- A. See Section 01740: Warranties and Bonds.

END OF SECTION

SECTION 11400

GRIT REMOVAL SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: described in this section includes furnishing all labor, equipment, materials, tools and incidentals required for a complete and operable aerated grit removal system as shown on the drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Metals: Division 5.
 - 4. Process Instrumentation and Controls - Products: Division 13.
 - 5. Electrical: Division 16.
- C. Operating Conditions
 - 1. Application Grit removal downstream of screens
 - 2. Quantity one (1)
 - 4. Peak Capacity 0.48 MGD
- D. System Requirements
 - 1. The grit removal system shall remove 90% of all grit particles with specific gravity of 2.65 greater than or equal to 150 microns (100 mesh) at the peak design flow of 0.5 MGD.
 - 2. The grit removal system shall be comprised of a primary grit separator and all necessary blowers for aeration and airlifting of grit, grit cleaning mechanism, air-liquid separation unit, circulating motive jet nozzle, supporting bridge work, integral grit transport mechanism (transport the grit from the storage chamber to disposal), duplex blower station, valves, internal piping (up to the connection points of the influent, effluent, and grit discharge lines), and controls.
 - 3. The grit removal system shall be aerated and be a stand-alone unit. All appurtenances shall be supplied by a single supplier.

4. The grit removal system shall use a forced vortex to separate solids from liquids. Grit removal systems utilizing plate-settling technology will not be acceptable. The system shall be pneumatically-assisted and shall not require moving parts or external instrumentation.
5. Data on performance testing, service history and operation of submitted equipment shall be made available to the Engineer for use in determining that the grit removal system offered meets the intent of the contract, performance requirements and criteria stated in these specifications.
6. The grit separator shall be manufactured of FRP. Coating shall comply with Section 09900, Painting.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer or Packager Qualifications: Supplier shall have experience in providing similar equipment, and shall show evidence of satisfactorily operating installations in the United States.
2. Packagers must be an Authorized Distributor or Representative of the equipment supplier.
3. Equipment supplier must be Factory Authorized to perform all phases of warranty work.

1.03 SUBMITTALS

- A. Shop Drawings and Manufacturer's Literature: All equipment to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. The submittals shall include the following:
1. Manufacturer's catalog data and descriptive literature.
 2. General arrangement and dimensional drawings of the grit removal system.
 3. Written recommended procedures for job site storage, handling, installation, and start-up of the equipment.
- B. Operation and Maintenance Manuals: For grit chambers furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data.
- C. Certificate of Compliance: The Contractor shall furnish the Engineer with a written certification signed by the manufacturer's representative that the equipment has been properly installed, is in accurate alignment, and has been operated under simulated full load conditions and that satisfactory operation has been obtained.

PART 2 – PRODUCTS

2.01 GENERAL DESIGN CRITERIA

- A. Performance objective: 90% removal of all grit particles with specific gravity of 2.65 greater than or equal to 150 microns (100 mesh) at a total peak design flow of 0.5 MGD. The grit removal system shall be models manufactured by Fluidyne Corporation, Hydro International, Smith & Loveless, or equivalent.
- B. The proposed grit removal system shall be designed to meet the following criteria:
 - 1. Peak design flow: 0.5 MGD
 - 2. Average daily flow: 0.16 MGD
 - 3. Inlet pipe diameter: 12 in.
 - 4. Underflow pipe diameter: 4 in.
 - 5. Outlet pipe diameter: 12 in.
 - 6. Head loss at the peak design flow: < 8 in. water column
 - 7. Head loss at the average daily flow: < 2 in. water column
 - 8. Operating pressure: Atmospheric
- A. Degritting: airlift discharge to screened container.

2.02 GRIT REMOVAL SYSTEM COMPONENTS

- A. The grit removal device shall be capable of handling flows from zero (0) to a peak flow of up to 0.5 MGD. The grit removal device shall be capable of removing 90% of the grit greater than 100 mesh in size. The grit removed shall be transported to a storage hopper separated from the grit removal device by a transition surface having an opening to permit passage of the grit. The transition section shall have a sloped section so as to provide hydraulic conditions favorable for the removal of organics before the grit passes through the opening to the grit storage chamber. Air shall be introduced at the base of the unit to lift and re-circulate water in the grit chamber for aerating and scouring. An air-liquid separation unit shall be provided at the top of the airlift unit to separate air from the re-circulation stream. Jet motive nozzle shall be provided and so designed as to impinge upon the sloped section of the transition section and provide circulation in the grit chamber.
- B. Flow circulation shall be driven by compressed air from a duplex regenerative blower station. Grit transport airlift shall be driven by a compressed air source from an integral rotary positive displacement blower.

- C. The grit chamber shall be designed to handle a wide range of flows from zero up to peak flow of 0.5 MGD without loss of grit removal efficiency. The inlet flume transporting the liquid waste to the grit chamber shall be of the size and shape shown on the contract drawings to assure that grit does not settle in the inlet flume and to provide for proper operation of the grit chamber.

2.03 AUXILIARY EQUIPMENT

- A. Grit Airlift/ Air Scour Assembly

A 4" airlift pump shall be furnished to facilitate grit washing and removal. The 4" diameter airlift pump shall be designed to be concentric with the flow circulation unit. The airlift pump shall be suitable for manual or automated operation by control of the compressed air supply to the airlift unit. The air supply line shall terminate above the bridge work. Air supply piping from the source of the air supply to the control valves shall be furnished by the contractor.

- B. Vortex Grit Separator

A fiberglass 24" diameter vortex grit separator shall be an integral part of the grit removal system. The vortex separator shall receive the discharge from the grit airlift pump. The degritted sewage shall exit the unit from the main discharge and the grit shall exit the grit chamber to a grit dewatering device.

- C. Fiberglass Chamber

The manufacturer shall provide, in addition to the grit mechanism, a pre-fabricated fiberglass (FRP) chamber, bridges and internal flanged transition pieces that will allow for bolting or attaching to flanged pipe as specified. The fiberglass chamber shall be constructed in accordance with NBS PS 15-69 standards. The tankage shall be constructed of a polyester resin using continuous filament winding and woven mat. All transitions, inlets and outlets shall be factory installed using acceptable fiberglass weld procedures outlined in PS 15-69 standards. The finished unit shall be given a minimum 8 mils coating of finish gel-coat with UV inhibitors. Any field repair or field welds shall be done with materials provided by the manufacturer to insure like materials are used.

The FRP chamber shall be of sufficient diameter and include inlet and outlet flange connections. The unit shall be supported on four(4) support legs with flanges to allow anchoring into the concrete floor.

- D. Grit Fluidizing

A 1" clean water connection port shall be provided to be connected to water supply line (provided by others) for fluidizing the bottom of the grit chamber prior to the grit airlift blower operating. A 1" normally closed, 120 VAC, single phase, 60 Hz,

solenoid valve shall be provided to control the fluidizing function. A 1" manual ball valve shall be provided upstream of the solenoid valve to allow isolation of the solenoid valve for service.

E. Regenerative Blower

Regenerative blower with intake filter shall be provided to supply 60 SCFM at 1.6 psig. Unit shall be provided with a 1HP, 460 V, 3 phase TEFC motor.

F. Positive Displacement Blower for Grit Airlift

A positive displacement blower with intake filter, silencer and accessories shall be provided to supply 30 SCFM at 3.2 psig. The unit shall be provided with a 3 HP, 460 V, 3 phase TEFC motor.

G. Controls

The controls and motor starter for the grit system shall be incorporated in a NEMA 4X stainless steel enclosure approximately 30" high x 24" wide x 8" deep. The panel shall incorporate 460 volt, 3 phase starters for the circulation blower and the grit airlift blower.

The control panel shall include an On-Off-Auto three-position selector switch and indicating light for each blower and grit fluidizing valve. In the automatic position a 24-hour timer, settable in 10-minute increments shall start grit removal process by opening the grit fluidizing solenoid and starting a timer. When the timer times out it start the grit airlift blower and start a second timer. When the second timer times stop the grit airlift blower, start the grit classifier and reset when the contact on the 24-hour timer releases.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The primary grit removal unit and the auxiliary equipment shall be delivered to site fully fabricated, subject to size, packaging and transportation constraints.
- B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is complete and the units and equipment are ready for operation.
- C. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
- D. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

- E. Each box or package shall be properly marked to show its net weight in addition to its contents.
- F. The grit removal unit and auxiliary items shall be shipped within 20 weeks from date of approved shop drawings and specifications.

3.02 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation.
- A. Degritting Control Sequence:
A time clock shall initiate when grit discharge cycles occur. The time clock shall be adjustable to initiate a cycle up to every 5 minutes. When the fluidizing timer times out, the solenoid valve shall close and the electrically actuated plug valve connected to the 4-inch diameter underflow pipe shall open for an adjustable period of time (typically 120 seconds). This process repeats when the next cycle time programmed in the time clock is attained.

3.03 FIELD PAINTING

- A. Field painting is specified under Section 09900. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to assure compatibility.
- B. All nameplates shall be properly protected during painting.

3.04 STARTUP, INSPECTION, AND TESTING

- A. Startup Support: A factory trained representative for the equipment specified herein shall be present at the jobsite and/or classroom designated by the Owner for a maximum of two 8-hour man-days (one visit) for installation inspection, plant startup, functional testing, and operator instructions; travel time excluded. A minimum of 30 days notice is required to schedule manufacturer's services. Any services with less than 30 days notice shall be billed for service time and actual travel costs.
- B. Functional Testing: Prior to plant startup, all equipment shall be inspected for proper alignment, operation, connection, and satisfactory performance by means of a functional test.

- C. Provide manufacturer's certificate of installation and commissioning following functional testing and startup.

3.05 WARRANTY

- A. Unless otherwise defined in Section 01740, the grit removal system shall be free from defects in materials and workmanship for a period of 12 months following acceptance. Any defects found within the warranty period shall be repaired at no expense to the Owner.

END OF SECTION

SECTION 11401

SCREENS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The contractor shall furnish and install a mechanical spiral screen and a manual bar screen as well as all associated work as shown in the drawings. The mechanical spiral screen shall be complete with all accessories, spare parts, mounting, anchor bolts and all other accessories and appurtenances as specified and as may be required for a complete and operating installation. The manual bar screen shall be complete and include screen, fittings, mounts, and spare parts.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Metals: Division 5.
 - 4. Process Instrumentation and Controls - Products: Division 13.
 - 5. Electrical: Division 16.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Each manufacturer shall submit a list of at least five U.S. installations on similar applications which have been in continuous operation for at least two years.
 - 2. Acceptable manufacturers include Vulcan Industries and EIMCO Water Technologies.
 - 3. To be considered acceptable as alternate process equipment, the manufacturer shall send the Engineer a written request 14 days prior to the bid which is to include such drawings, specifications, literature, performance data, list of installation in US as well as in state of Florida, and other information necessary to describe the proposed equipment as meeting the minimum requirements of the project.
- B. References:
 - 1. American Gear Manufacturers Association (AGMA)

2. National Electrical Manufacturers Association (NEMA)
3. American Federation of Bearing Manufacturers Association (AFBMA)
4. American Society for Testing and Materials (ASTM)
5. American Welding Society (AWS)
6. Steel Structures Painting Council, American National Standards Institute (SSPC)
7. Underwriters Laboratory (UL)

1.03 SUBMITTALS

- A. Shop Drawings and Manufacturer's Literature: All equipment to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. The submittals shall include the following:
 1. Manufacturer's catalog data and descriptive literature.
 2. General arrangement and dimensional drawings of the grit removal system.
 3. Written recommended procedures for job site storage, handling, installation, and start-up of the equipment.
- B. Operation and Maintenance Manuals: For grit chambers furnished under this Section, the Contractor shall submit operation and maintenance manuals in accordance with Section 01730 Operating and Maintenance Data.
- C. Certificate of Compliance: The Contractor shall furnish the Engineer with a written certification signed by the manufacturer's representative that the equipment has been properly installed, is in accurate alignment, and has been operated under simulated full load conditions and that satisfactory operation has been obtained.

PART 2 – PRODUCTS

2.01 GENERAL DESIGN CRITERIA

- A. Mechanical Spiral Screen Design Requirements

Number of Units: One (1)

Average Flow Rate: 0.16 MGD

Peak Flow Rate: 0.48 MGD

Flow Channel Width: 1'-6"

Flow Channel Depth: 2'-6"

Screen Opening Size: ¼-inch

Setting Inclination: 45 degrees from horizontal (maximum)

B. Manual Bar Screen

1. The contractor shall furnish and install a manual bar screen as shown in the drawings. The manual bar screen shall be complete and include a screen, mount, spare parts and all other accessories in accordance with the contract documents. The screen shall be installed in channel that is specified in the drawings. The screen shall be capable of passing sanitary sewage with a maximum water depth in the channel of 2.0 feet. The system shall operate by means of a bar screen to retain debris.
2. The bar screen shall consist of rectangular Type 304 stainless steel bar fastened firmly at the top and bottom. The bars shall be straight and inclined from the horizontal in the downstream direction and shall span the full width of the channel. The bar screen shall be firmly anchored to the channel floor and to the dead plate at the top. There shall be no horizontal members allowed on the bar screen below the design water level. The dead plate shall be constructed of stainless steel plate, suitably reinforced.

2.02 GENERAL

- A. The spiral screen furnished shall positively remove debris from the incoming wastewater by means of a perforated screening basket to capture solids and a brush mounted on a rotating shaftless screw. The perforated screening basket shall be installed in the channel as shown on the Contract Drawings. During each cleaning cycle, the shaftless screw shall rotate and the brush shall engage the screening basket, which will transport the screenings material upward. Intermittent cycling will eventually raise the screenings upward through the dewatering area and subsequently out of the discharge area into a receiving container.
- B. Designs employing the use of shafted screws, endless moving media, cables and hydraulic cylinders or raking mechanisms to remove debris from the channel are not acceptable. The use of two or more motors to complete a screen cleaning cycle is not acceptable.
- C. The design shall be such to ensure that all maintenance can be accomplished at the operating floor level. No part of the drive system including bearings, linkage, bushings or shafts shall be located below the water surface at maximum design flow.

2.03 SCREEN

- A. The screen shall consist of a semicircular, perforated 304 stainless steel screening basket. The screening basket shall have 1/4-inch diameter perforations. The basket shall have a base plate along the bottom and a flanged

top to connect the conveyance tube. The basket shall be removable without the need to remove the spiral. Neoprene side seals shall be attached to the sides of the screening basket with stainless steel retainers and hardware to seal between the screen and channel walls.

- B. The screen shall be designed to mount into the channel without the need for recesses in the channel walls or channel floor. The screen shall be inclined at 45-degrees from the horizontal.

2.04 CONVEYANCE TUBE

- A. The conveyance tube shall be constructed of flanged pipe with a minimum thickness of 1/8-inch. The conveyance tube shall extend from the top of the screening basket to the discharge chute. A solenoid valve controlled washing nozzle assembly shall be located in the lower portion of the conveyance tube to assist in dissolving of organic material.
- B. Three (3) replaceable guide rails shall be provided in the lower portion of the conveyance tube to support the spiral and to help prevent the carry over of screenings debris. All bolted connections between the guide rails and the tube shall be sealed with specially shaped plastic washers.
- C. A hinged support stand with base plate shall be mounted to the underside of the conveyance tube to allow the entire assembly to pivot out of the channel for maintenance. The support stand shall be vertically adjustable.
- D. All structural components of the conveyance tube shall be manufactured of 304 stainless steel.

2.05 COMPACTION ZONE

- A. The compaction zone shall consist of a U-shaped trough section with a removable enclosure plate. An adjustable, spiral mounted cone manufactured of alloy steel shall be used to compact screenings prior to discharge. The cone shall be mounted on the shafted portion of the spiral and shall be adjustable. The cone shall be provided with two plates mounted perpendicular to the spiral to assist in the removal of compacted screenings debris.
- B. A solenoid valve controlled washing nozzle assembly shall be located in the compaction zone to assist in the cleaning of this area. The lower portion of the compaction zone shall be perforated to allow drainage.

- C. A drainage pan with drainpipe shall be provided. All structural components in the compaction zone shall be manufactured of 304 stainless steel.

2.06 SPIRAL

- A. The spiral shall be constructed of alloy steel and shall be of the shaftless design with a stub shaft attached to the gearmotor. The outer portion of the spiral shall be manufactured from bar stock that is nominally 2-3/4-inches wide by 1-inch thick and the inner portion of the spiral shall be continuously formed from bar stock that is nominally 2-inches wide by 3/4-inch thick. The spiral shall have a nominal outside diameter of 7-inches.
- B. Designs that utilize shaftless screws constructed of welded sections or shafted screws throughout the entire length shall not be acceptable. A replaceable brush shall be mounted on the outside of the spiral in the screening zone to clean the surface of the screening basket. Mounting tabs shall be provided on the spiral to mount the brush.

2.07 DRIVE ASSEMBLY

- A. The spiral screen shall be furnished with an integrated drive assembly consisting of a TEFC electric motor with a double reduction helical worm gear reducer, drive shaft, bearings, sprockets and dual drive chains.
- B. The motor shall be a minimum 1.5 horsepower, 230/460 volt, 3 phase, 60 Hertz with a service factor of 1.15. The motors shall be rated at 40°C ambient with Class F insulation and shall have a Class B temperature rise at full load. The nominal motor speed shall be 1800 rpm.
- C. The gear reducer shall be of the parallel-helical worm gear type and shall be capable of elevating the weight of the drive assembly plus its maximum calculated debris load. Gear reducers shall have ball or roller bearings throughout with all moving parts immersed in oil. Worm shall be of alloy steel with threads precision ground and polished after casehardening. The worm gear shall either be of all high strength alloy bronze or alloy bronze-rimmed semi-steel. Shafts shall be of high strength alloy steel ground to required tolerances. All ball or roller bearings shall be rated and manufactured by a member of the Antifriction Bearing Manufacturer's Association. At least one bearing on each shaft shall be of the combined radial and thrust type.

2.08 DISCHARGE CHUTE

- A. A fully shrouded discharge chute shall be provided at the point of discharge to direct the screenings into the appropriate receiving device. The discharge chute shall have a minimum thickness of 20-gauge and shall be manufactured of 304 stainless steel.

2.09 CONTROLS

- A. The spiral screen shall be cycled on and off by remote control signals from the main control panel.
- B. The control system, both local and main, shall be designed and manufactured by the same company that furnishes the mechanical screen.
- C. LOCAL CONTROLS
 - 1. One (1) NEMA 4X local control station with a mushroom head EMERGENCY STOP push-button.
 - 2. One (1) brass body solenoid valve shall be furnished to provide wash water to the screening and de-watering areas of the screen. The solenoid valve shall be mounted on the screen assembly.
 - 3. The local controls and motor shall be pre-wired to a terminal strip located inside the local control station mounted on the screen.
- D. MAIN CONTROLS
 - 1. The main control panel shall be a totally enclosed, front access type with top/side/bottom entry. The panel shall be manufactured by a U.L. listed control panel facility and shall bear a U.L. label. Construction of the control panel enclosure shall be NEMA 4X, 304 stainless steel with indicating devices and switches mounted on the front door.
 - 2. Main control panel wiring shall be color-coded, labeled, neatly cabled and supported in nonflammable wiring raceways. Wiring shall be minimum 16-gauge MTW stranded wire.
 - 3. The control panel wiring shall contain all power and control devices shown on the Contract Drawings (wiring diagrams), which shall include, but not be limited to, the following:
 - a) One (1) control power ON-OFF selector switch.
 - b) One (1) HAND-OFF-AUTO selector switch for operation of the screen drive.
 - c) One (1) FORWARD-OFF-REVERSE selector switch for manual operation. Spring return from REVERSE to OFF.
 - d) One (1) red pilot light for "Screen Run" indication.
 - e) One (1) amber pilot light for "Over Current" indication.
 - f) One (1) white pilot light for control power.
 - g) One (1) momentary "reset" push-button for over current reset.
 - h) Spare contact for remote indication of "Over Current" status.
 - i) Control relays, wiring and circuitry required to implement the control logic.
 - j) One (1) full voltage NEMA rated reversing starter The magnetic starter

shall be of the heater less design and provide phase loss protection, short circuit self-protection and thermal memory. The solid-state overload shall be self-powered.

- k) One (1) circuit breaker
- l) One (1) 120 VAC control power transformer
- m) One (1) Milltronics HydroRanger 200 differential level controller to sense the differential in water level upstream and downstream of the spiral screen
- n) One (1) current sensing relay. The current sensing relay shall continuously monitor the motor current to prevent damage due to a jam obstruction or a unit malfunction. An over current condition that causes motor shutdown shall cause an alarm to sound. The alarm shall be manually reset prior to the unit returning to normal operation
- o) One (1) single channel electronic control timer to automatically initiate operation of the spiral screen. The timer shall be capable of up to 30 events (on, off or momentary on)
- p) One (1) elapsed time meter.

- E. All selector switches, pushbuttons and pilot lights shall be NEMA rated components. IEC rated components are not acceptable.

2.10 SEQUENCE OF OPERATION

- A. The spiral screen shall be cycled on and off by remote control signals from the main control panel.
- B. Normal timer start shall be overridden by a demand signal generated from a differential level controller. The differential level controller located within the remote control panel shall measure the head loss across the spiral screen. Once a preset level differential has been reached, a signal in the form of a dry contact closure is generated for starting the screen. Once directed to start, the screen will continue to operate until the head loss is reduced to a preset operating differential level. Differential level shall be measured by ultrasonic transducers mounted upstream and downstream of the spiral screen.

2.11 FASTENERS

- A. All fasteners and anchor bolts shall be 304 stainless steel unless otherwise indicated in this specification. Anchor bolts shall be provided for mounting support arms. All threaded fasteners shall be coated with a nickel based anti-seize thread lubricant prior to assembly.

2.12 LUBRICATION

A. The manufacturer shall state in the operating manual the amount of and specification for any lubricant required.

2.13 PROTECTIVE COATINGS

- A. Stainless steel and plastic components shall not be painted. The stainless steel structural components and enclosure panels shall be passivated after fabrication to remove embedded iron, surface rust and weld burn. All other surfaces shall be blast cleaned to an SSPC-SP6 finish, removing all dirt, rust, scale and foreign materials.
- B. Cleaned surfaces shall be shop primed with one (1) coat of TNEMEC 69-1212 primer, or equal, to attain a minimum dry film thickness of 2.5 mils. The motor and gear reducer shall have manufacturer's standard paint finish and the motor and gear reducer shall be painted the same color.

2.14 SPARE PARTS

The Manufacturer shall furnish one (1) set of wear bars with attachment hardware and three (3) brushes for the spiral as spare parts.

- A. All spare parts shall be properly packed in a white wooden box, labeled and stored where directed by the Owner or Engineer.

PART 3 – EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall store and temporarily support equipment prior to installation in strict accordance with the Manufacturer's recommendations and instructions. Protect all exposed surfaces. Keep records of the storage parameters and the dates that storage procedures were performed. The Contractor shall be responsible for work, equipment and materials until inspected, tested and finally accepted.
- B. Protect the equipment from being contaminated by dust, dirt, vibration and moisture.
- C. Temporarily connect equipment with built in space heaters to a power source and keep heaters in operation. Rotate all shafts that have bearings on at least a monthly basis.
- D. The spiral screen shall be shipped complete including the motor and excluding the support arm. The unit shall be erected and lubricated in strict accordance with the instructions of the Manufacturer's field engineer.

3.02 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings.
- B. The contractor shall submit a certificate from the equipment manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation.

3.03 TESTING

- A. The spiral screen shall be factory assembled and factory run tested in the United States prior to shipment. The main control panel shall also be factory tested.
- B. The screen shall also be field tested after erection in the presence of the Owner and Engineer to confirm and verify the structural and mechanical compliance to the specification. The field acceptance test shall include demonstrating that the screen operates without vibration, jamming or overheating and perform its specified function satisfactorily.

3.04 INITIAL START-UP AND TRAINING

- A. The Contractor shall provide the services of a factory-employed service technician who shall adequately inspect the installation, test the equipment furnished under this Contract and instruct the Owner's operating personnel in its maintenance and operation. Factory personnel are required. Manufacturer's sales representatives are not deemed acceptable service technicians. The services of the technician shall be provided as follows:

One (1) trip of two (2) days of service to inspect and certify the installation prior to startup and provide Owner's personnel in proper operation and maintenance of the equipment.

3.05 WARRANTY

- A. The equipment supplier shall warrant that its equipment shall be free from defects in material and workmanship; and that it will replace or repair, F.O.B. its factory, any part or parts returned to it which examination shall show to have failed under normal use and service by the user within eighteen (18) months following initial shipment or twelve (12) months following operation start-up, whichever occurs first.

END OF SECTION

SECTION 11500

SPRAY IRRIGATION SYSTEM

PART I - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work under this section includes the furnishing of all labor, materials, equipment, documentation, training for the installation of a spray irrigation system that includes one hundred and four (104) sprinklers, piping and all associated accessories. The spray irrigation system shall be as listed under the Service Conditions and as shown on the drawings and specified herein (the "Work"). Individual system requirements are as indicated at the end of this section.
- B. Related Work Described Elsewhere:
 - 1. Materials and Equipment: Section 01600.
 - 2. Painting: Section 09900.
 - 3. Metals: Division 5.
 - 4. Process Instrumentation and Controls - Products: Division 13.
 - 5. Process and Utility Piping, Fittings, Valves, and Accessories: Section 15050
 - 6. Piping, Valves and Specialties: Section 15200
 - 7. Electrical: Division 16.

1.02 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer or Packager Qualifications: Supplier shall have experience in providing similar equipment, and shall show evidence of satisfactorily operating installations in the United States.
 - 2. Packagers must be an Authorized Distributor or Representative of the equipment supplier.
 - 3. Equipment supplier must be Factory Authorized to perform all phases of warranty work.

1.03 SUBMITTALS

- A. Shop Drawings and Manufacturer's Literature: All equipment to be furnished under this Section shall be in accordance with Section 01340: Shop Drawings, Working Drawings and Samples. The submittals shall include the following:
 - 1. Manufacturer's catalog data and descriptive literature.
 - 2. General arrangement and dimensional drawings of the sprinkler heads and associated equipment.
 - 3. Written recommended procedures for job site storage, handling, installation, and start-up of the equipment.

PART 2 – PRODUCTS

2.01 GENERAL DESIGN CRITERIA

- A. Sprinkler heads must be able to have a trajectory angle greater than 25 degrees.
- B. Operating range of the sprinkler heads must be between 30- 60 psi.
- C. The flow rate for each sprinkler shall be between 3.7-8.0 GPM.
- D. The radius of the sprinkler shall be in the range of 40-50 feet.

2.02 SPRINKLER HEADS

- A. Sprinklers shall be of the full or part circle type and made of brass. Springs and fulcrum pin inside each sprinkler shall be made of stainless steel. All washers shall be chemically resistant in order to prevent corrosion. Sprinkler heads must conform to design criteria listed in 2.01.

2.03 NOZZLE

- A. Nozzles shall be of the straight bore adjustable, adjustable or keyhole type and made of brass. Nozzles shall include integral break-up pin and distance flap. All nozzles shall be chemically resistant in order to prevent corrosion. Nozzle heads must conform to design criteria listed in 2.01.

2.04 PIPING

- A. All piping, fittings and accessories associated with the spray irrigation system shall be in general conformance with section 15050 and 15200.

PART 3 – EXECUTION

3.02 INSTALLATION

- A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations in the locations shown on the Drawings.

3.05 WARRANTY

- A. Unless otherwise defined in Section 01740, the grit removal system shall be free from defects in materials and workmanship for a period of 2 years. Any defects found within the warranty period shall be repaired at no expense to the Owner.

END OF SECTION

SECTION 13125
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Metal soffit panels.
5. Thermal insulation.
6. Doors and frames.
7. Windows.
8. Accessories.

B. Related Sections:

1. Division 8 Section "Overhead Coiling Doors."
2. Division 8 Section "Sectional Overhead Doors."

1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system.
2. Metal roof panels.

3. Metal wall panels.
4. Metal liner panels.
5. Insulation and vapor retarder facings.
6. Flashing and trim.
7. Doors.
8. Windows.
9. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
 - c. Show translucent panels.
4. Accessory Drawings: Include scaled details of the following items;
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - d. Roof ventilators.
 - e. Louvers.
 - f. Service walkways.

C. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.

1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.

2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

D. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Welding certificates.

F. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - a. Name and location of Project.
 - b. Order number.
 - c. Name of manufacturer.
 - d. Name of Contractor.
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - g. Governing building code and year of edition.
 - h. Design Loads: Include dead load, roof live load, collateral loads, wind loads/speeds and exposure specific to Columbia County FL.
 - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

G. Manufacturer Certificates: For each product, from manufacturer.

H. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Non-shrink grout.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

J. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

K. Warranties: Sample of building warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.

1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

E. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

F. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

G. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
2. Combustion Characteristics: ASTM E 136.

H. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply

with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements:
 - 1. Established Dimensions for Foundations: Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- B. Coordinate installation of roof curbs equipment supports and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

- C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- 2. Finish Warranty Period: 15 years from date of Substantial Completion.

- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

- 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers or others offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- 1. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
- 2. Alliance Steel, Inc.
- 3. American Buildings Company; Division of Magnatrac Corp.
- 4. American Steel Building Co., Inc.
- 5. BC Steel Buildings, Inc.
- 6. Behlen Mfg. Co.
- 7. Bigbee Steel Buildings, Inc.

8. Butler Manufacturing Company; a BlueScope Steel company.
9. CBC Steel Buildings; Division of Magnatrax Corp.
10. Ceco Building Systems; Division of NCI Building Systems, L.P.
11. Chief Buildings; Division of Chief Industries, Inc.
12. Elite Structures, Inc.
13. Garco Building Systems; Division of NCI Building Systems, L.P.
14. Gulf States Manufacturers, Inc.; Division of Magnatrax Corp.
15. Inland Buildings; Subsidiary of Behlen Mfg. Co.
16. Kirby Building Systems; Division of Magnatrax Corp.
17. Mesco Building Solutions; Division of NCI Building Systems, L.P.
18. Metallic Building Company; Division of NCI Building Systems, L.P.
19. Metco Metal Supply.
20. Mid-West Steel Building Company; Division of NCI Building Systems, L.P.
21. Nucor Building Systems.
22. Oakland Metal Buildings, Inc.
23. Olympia Steel Building Systems.
24. Package Industries, Inc.
25. Pinnacle Structures, Inc.
26. Robertson Building Systems; an NCI company.
27. Ruffin Building Systems, Inc.
28. Schulte Building Systems, LLP.
29. Spirco Manufacturing.
30. Star Building Systems; an NCI company.
31. Tyler Building Systems, L.P.
32. USA, Inc.
33. VP Buildings; a United Dominion company.
34. Vulcan Steel Structures, Inc.
35. Whirlwind Building Systems.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather in Columbia County Florida without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. End-Wall Framing: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.

- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and girts.
- E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
- F. Bay Spacing: As determined by manufacturer.
- G. Roof Slope: 3 inch per 12 inches (3:12) Manufacturer's standard for frame type required.
- H. Roof System: Manufacturer's standard standing-seam metal roof panels with field-installed insulation.
- I. Exterior Wall System: Manufacturer's standard tapered-rib, concealed-fastener metal wall panels with field-installed insulation.

2.3 METAL ROOF PANELS

A. Trapezoidal-Rib, Standing-Seam Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Zinc-coated (galvanized) Aluminum-zinc alloy-coated steel sheet, 0.034-inch (0.86-mm) nominal thickness.
 - a. Color: As indicated by manufacturer's designations.
2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel aluminum-zinc alloy-coated steel zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
3. Joint Type: Panels snapped together.
4. Joint Type: Mechanically seamed, folded according to manufacturer's standard.
5. Panel Coverage: 24 inches (610 mm).
6. Panel Height: 3 inches (76 mm).

B. Materials:

1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - a. Surface: Smooth, flat Embossed finish.

C. Finishes:

1. Exposed Coil-Coated Finish:

- a. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.4 METAL WALL PANELS

A. Concealed-Fastener Metal Wall Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges; with flush joint between panels; with ~~1-inch-~~ (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.

1. Material: Zinc-coated (galvanized) Aluminum-zinc alloy-coated steel sheet, ~~0.034-inch~~ (0.86-mm) nominal thickness.

2.5 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: Match profile and material of metal roof panels.

1. Finish: Match finish and color of metal roof panels.

C. Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges; with flush joint between panels; with ~~1-inch-~~ (25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.

1. Material: Zinc-coated (galvanized) Aluminum-zinc alloy-coated steel sheet, ~~0.034-inch~~ (0.86-mm) nominal thickness.

2.6 THERMAL INSULATION

- A. Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. (8-kg/cu. m) density; 2-inch- (51-mm-) wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm (1.15 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Desiccant Method.
 - a. Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.
- B. Retainer Strips: 0.025-inch (0.64-mm) nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
- C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
1. Steel Doors: 1-3/4 inches (44 mm) thick; fabricated from 0.040-inch (1.02-mm) nominal-thickness, metallic-coated steel face sheets; of seamless, hollow-metal construction; with 0.064-inch (1.63-mm) nominal-thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
 - a. Design: Flush panel.
 2. Steel Frames: Fabricate 2-inch- (51-mm-) wide face frames from 0.064-inch (1.63-mm) nominal-thickness, metallic-coated steel sheet.
 - a. Type: Knocked down for field assembly.
 3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
 4. Hardware:
 - a. Provide hardware for each door leaf, as follows:
 - 1) Hinges: BHMA A156.1. Three plain antifriction-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches (114 by 114 mm), with nonremovable pin.
 - 2) Lockset: BHMA A156.2. Key-in-lever cylindrical Mortise, with lever handle type.

- 3) Threshold: BHMA A156.21. Extruded aluminum.
 - 4) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.
 - 5) Weather Stripping: Vinyl applied to head and jambs, with vinyl sweep at sill.
5. Anchors and Accessories: Manufacturer's standard units, galvanized according to ASTM A 123/A 123M.
 6. Fabrication: Fabricate doors and frames to be rigid; neat in appearance; and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.

B. Materials:

1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
2. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Finishes for Personnel Doors and Frames:

1. Prime Finish: Factory-apply manufacturer's standard primer immediately after cleaning and pretreating.
 - a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
2. Factory-Applied Paint Finish: Manufacturer's standard, complying with SDI A250.3 for performance and acceptance criteria.
 - a. Color and Gloss: As indicated by manufacturer's designations.

2.8 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants,

gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel stainless-steel sheet or nylon-coated aluminum sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

C. Gutters: Formed from **0.022-inch (0.56-mm)** nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum **96-inch (2438-mm-)** long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."

1. Gutter Supports: Fabricated from same material and finish as gutters.
2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.

D. Downspouts: Formed from **0.022-inch (0.56-mm)** nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum **10-foot- (3-m-)** long sections, complete with formed elbows and offsets.

1. Mounting Straps: Fabricated from same material and finish as gutters.

E. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.

1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from **0.022-inch (0.56-mm)** nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum **10-foot- (3-m-)** long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.

F. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum **0.052-inch (1.32-mm)** nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from **0.040-inch (1.02-mm)** nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.

1. Blades: Fixed.

2. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m) for 48-inch- (1220-mm-) wide by 48-inch- (1220-mm-) high louver.
3. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
 - a. Mounting: Exterior face of louvers.
4. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

G. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
 - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.9 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing.
 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Locate canopy framing as indicated.
 4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists and Joist Girders: Install joists, girders, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
 5. Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels

and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge and hip caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
 - 6. Provide metal closures at peaks rake edges rake walls and each side of ridge and hip caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)** on slope and location lines as indicated and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels **4 inches (102 mm)** minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Pre-drill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of **1/4 inch in 20 feet (6 mm in 6 m)**, nonaccumulative, on level, plumb, and on location lines as indicated, and within **1/8-inch (3-mm)** offset of adjoining faces and of alignment of matching profiles.

3.7 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.

- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
 - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

3.9 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place according to manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames according to SDI A250.8. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
1. Between Doors and Frames at Jambs and Head: **1/8 inch (3 mm)**.
 2. Between Edges of Pairs of Doors: **1/8 inch (3 mm)**.
 3. At Door Sills with Threshold: **3/8 inch (9.5 mm)**.
 4. At Door Sills without Threshold: **3/4 inch (19.1 mm)**.
 5. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- C. Door Hardware: Mount units at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
1. Install surface-mounted items after finishes have been completed on substrates involved.
 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 4. Set thresholds for exterior doors in full bed of butyl-rubber sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.10 WINDOW INSTALLATION

- A. General: Install windows plumb, rigid, properly aligned, without warp or rack of frames or sash, and securely fasten in place according to manufacturer's written instructions.

Coordinate installation with wall flashings and other components. Seal perimeter of each window frame with elastomeric sealant used for metal wall panels.

1. Separate dissimilar materials from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Mount screens directly to frames with tapped screw clips.
- E. Field Glazing: Comply with installation requirements in Division 8 Section "Glazing."

3.11 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
 1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or

bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Tie downspouts to underground drainage system indicated.

E. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

F. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during louver installation.

G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.12 ADJUSTING

A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.

- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.
- C. Windows: Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and at weather stripping to ensure smooth operation and weathertight closure. Lubricate hardware and moving parts.
- D. Roof Ventilators and Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily and be free of warp, twist, or distortion as needed to provide fully functioning units.

3.13 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.
- F. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

G. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.

1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 13125

SECTION 13201

CIRCULAR PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Requirements specified in Conditions of Contract and Division 1: General Requirements form a part of this Section. Provide for the design and construction of the following prestressed concrete tanks: one (1), 66 foot diameter circular ground storage tank and one (1), 22 diameter circular digester tank. Tanks must conform to the dimensions and locations shown on the Drawings. The tank construction company shall furnish all engineering services required for the preparation of design calculations and detailed design drawings, and furnish all materials, labor and equipment for the construction of the prestressed tank as shown on the Drawings and as specified herein.
2. The prestressed concrete tanks shall be of composite steel-shotcrete, wire-wound, prestressed construction. The wire-wound prestressed composite wall shall include a shotcrete core wall in which a steel shell diaphragm of a height equal to the full wall height has been encased. All prestressing shall be done with high tensile wire permanently bonded to the tank wall. The tank floor shall be of concrete or shotcrete construction containing no less than 0.6 percent of reinforcing steel.

B. Related Work Described Elsewhere:

1. Excavation, Backfilling and Compaction: Section 02220.
2. Concrete Reinforcement: Section 03200.
3. Cast-In-Place Concrete: Section 03300.
4. Leakage Testing of Hydraulic Structures: Section 03800.
5. Structural Aluminum: Section 05140.
6. Metal Fabrication: Section 05500.

7. Handrails and Railing: Section 05520.
8. Aluminum Grating System: Section 05530.
9. Fabricated Fiberglass Reinforced Plastic Products: Section 06605
10. Painting: Section 09900.
11. Process and Utility Piping, Fittings, Valves and Accessories: Section 15050.

C. General Design

1. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.
2. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
3. All prestressing shall be done with high tensile steel wire in which a substantial allowance shall be made for loss of prestress due to shrinkage and plastic flow in the shotcrete and to relaxation in the steel wire and diaphragm.
4. Size and Configuration of Tank: The dimensions of the prestressed circular concrete tanks including the floor slopes, sumps, tank diameters and vertical wall heights shall be as indicated on the Drawings.
5. Design of the prestressed tanks shall accommodate the following differential and total settlements. As outlined in the attached geotechnical soils report.

- D. The contractor shall be responsible for coordinating all activities between the prestressed concrete tank manufacturer required for a complete installation. Activities requiring extensive coordination would include but not be limited to shop drawing submittals, embedded items required to be installed during construction of the prestressed concrete tank. Construction of the prestressed concrete tank shall not commence until all key dimensions, equipment and pipe locations, and any other interdependent items are approved by the Engineer, and any conflicts or ambiguities are resolved. It shall remain the contractor's sole responsibility to resolve any errors or conflicts arising during construction due to improper coordination between the prestressed concrete tank construction company.

1.02 QUALITY ASSURANCE

- A. Design Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the following standards, latest revisions.
1. Standard Building Code.
 2. ACI 301: Specifications for Structural Concrete for Buildings.
 3. ACI 318: Building Code Requirements for Reinforced Concrete.
 4. ACI 506R-85: Guide to Shotcrete.
 5. ACI 344: Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures.
- B. Qualifications and Experience of Tank Construction Company: The tank construction company shall have the following qualifications and experience:
1. The tank construction company shall specialize in the design and construction of wire-wound circular prestressed composite steel-concrete tanks. The tank construction company shall give satisfactory evidence that it has the skill, reliability and financial stability to design, build and guarantee the tank in accordance with the quality required by these specifications. The tank construction company shall have at least ten (10) years experience in this specialty and shall have built completely in its own name in the past five years no less than ten (10) prestressed composite tanks of comparable size, which meet these specifications and are now demonstrating satisfactory service. If all experience requirements cannot be met, an additional bond will be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
 2. The tank construction company staff shall include a full-time Professional Engineer registered in the State of Florida having no less than ten (10) years experience in the design and field construction of circular prestressed composite tanks who will be the responsible engineer in charge of the work to be done. All Working Drawings and design calculations shall carry the seal of such registered Professional Engineer.
 3. Acceptable Tank Manufacturer: The tank shall be as manufactured by the Crom Corporation, Gainesville, Florida; Precon Corporation, Newberry, Florida, or approved equal.

Any other tank construction company wishing to be considered shall submit a record of its experience in the design and construction of the type of tank

proposed for this project, including a list of the ten (10) tanks of the proposed size or larger now in service. Qualification data shall be submitted to the Engineer prior to 15 days before the date set for the receipt of bids. Any tank construction company considered acceptable will be notified prior to the bid date by the Engineer. Tank construction companies not pre-qualified prior to the bid shall not be considered.

B. Design Criteria: To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall:

1. The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.
2. The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.
3. Inside Face:
 - a. 26-gauge steel shell diaphragm continuous the full wall height, without horizontal splices.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
4. Outside Face:
 - a. Vertical reinforcing steel: Minimum of #4 bars at 12-inch center to center.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
5. Allowable Tensile Stress f_s 18,000 psi
Yield Strength f_y 40,000 psi
6. Design Loads: Wind loads, including uplift and overturning shall be as required by the Standard Building Code and any local amendments to the Code.
7. Qualifications of Workmen: The foreman, nozzle men, and gun men shall be skilled in their duties and certified in accordance with the guidelines by ACI Committee 506 Certification, latest revision. The contractor shall submit the names of the men performing the above duties, with a statement of certification as to their qualifications. Certification will be

accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.

*ELF - Engineering Laboratory Forum, Florida Institute
of Consulting Engineers
FC&PA - Florida Concrete and Products Association

1.03 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit a complete set of detailed shop drawings signed and sealed by a Florida Registered Professional Engineer for the work to be done. Inside dimensions, pipe openings and provisions for mechanical equipment shall be maintained as established by the Engineer. Shop drawings must be approved before construction may begin.
- B. Design Computations: The Contractor shall submit complete design computations. The design shall be done under the direction of a Florida Registered Professional Engineer and shall be signed or sealed by name of the design engineer. The design computations shall include all components of the tank, including wall, cantilevered launders, floor and sumps, wall penetrations, pipe supports, the wall reaction to the bottom slab, and the loads imposed by concrete dome covers. The design shall include consideration of temperature differentials under various conditions, stresses at wire winding and completed stages with tank empty and full, flexure in walls and base, anticipated movement of base under circumferential wire stresses, special stresses at wire anchorages and a construction procedure listing in chronological order the various operations of construction. The design computations shall be submitted for approval at least 30 days before the materials are assembled at the job site.
- C. Shop drawings shall be submitted showing complete details, dimensions, materials, fastenings, anchorages and special details of wall reinforcement at attachment of accessories and details of interior launder construction.
- D. If a sliding waterstop is used in the floor/wall joint, submit load/shear/deflection data to support shear and deflection calculations for base of wall. Tests shall have been generated for the particular waterstop configuration proposed.
- E. Submit to the Engineer, a guarantee document as specified in Paragraph 1.04, herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete

1. Concrete shall have a 28 day compressive strength of 4000 psi and shall be in conformance with the requirements of Section 03300: Cast-in-Place Concrete. Cement shall be Type II.

B. Shotcrete: Shall be in accordance with ACI Standard 506, latest revision, except as indicated otherwise herein. Proportions for all shotcrete shall be one part cement to 4 parts moist sand by weight, except that proportions of 1 to 3 shall be used for the cover coat on each side of the steel shell diaphragm and over the wire wrapping; these richer cover coats shall be at least 1/4-inch thick (measured from the outside of the wire for wire wrapping coat). Sand shall be composed of hard, strong, durable, uncoated grains of quartz in accordance with gradation limits in ACI 506, except that the fineness modulus maybe reduced to 2.0.

1. Compressive strength (f_g) shall be 4000 psi or greater at 28 days.
2. Allowable compressive stress (f_g) shall be determined by the formula $1250 + 75t$ with $0.45 f_g$ maximum where t is the core wall thickness.
3. Allowable compressive stress (f_g) due to initial prestressing force shall be $0.50 f_{gi}$ or less, with a minimum of 2000 psi, where f_{gi} is defined as compressive strength at time initial prestressing force is applied.
4. Cement shall be in accordance with the requirements of Section 03300: Cast-in-Place Concrete. Cement shall be Type II.

C. Prestressing Wire:

1. Cold drawn, high-carbon steel wire complying with ASTM A-648 Class II.
2. Wire size shall be 0.162-inch diameter (8 gauge) or larger, but no larger than 0.250-inch.
3. Working stress for wire in the wall (f_s) shall be 115,000 psi.
4. Allowable tensile stress before losses (f_{is}) shall be 145,000 psi or no greater than $0.70 f_s$.
5. Ultimate tensile strength (f_{su}) shall be 231,000 psi or greater.

D. Reinforcing Bars:

1. In conformance with ASTM A615, Grade 60, and with the requirements of Section 03200: Concrete Reinforcement.
 2. Floor slab bar supports shall be reinforced steel bolster.
- E. Wire Fabric Reinforcement:
1. Welded wire fabric shall conform to ASTM A185: Welded Wire Fabric for Concrete Reinforcement. Wire fabric shall be electrically welded and galvanized wire. Welded wire fabric shall be furnished in flat sheets; rolled WWF is not permitted.
 2. Welded wire fabric supports shall be plastic tipped bolsters with bar ties galvanized precast concrete blocks.
- F. Steel Shell Diaphragm:
1. Steel tank shell diaphragm shall be cold rolled sheet, minimum 26-gauge, conforming to ASTM A366 for Commercial Quality Cold Rolled Steel, with a Class 2, rolled finish or approved equal.
- G. PVC waterstops shall have minimum thickness of 3/8-inch in areas exposed to hydraulic loads.

2.02 ACCESSORIES

- A. Aluminum Handrails, Platforms and Grating:
1. Aluminum platforms shall be designed to support the intended live and dead loads with a minimum factor of safety of 2.0. The maximum deflection for platforms shall be limited to a maximum of 1:360 of the maximum span. Aluminum used for fabrication shall be structural aluminum shapes in accordance with Section 05140: Structural Aluminum, and Section 05500: Metal Fabrications. Aluminum grating used for platforms shall be in accordance with Section 05530: Aluminum Grating System. Aluminum handrailing installed around the dome access hatch and the aluminum access platforms shall be a three rail type handrail system, with a 4-inch toe board. Handrailing shall be constructed of 1 1/2-inch (1.90" o.d.), Schedule 40 aluminum pipe, Alloy 6063-T6, in accordance with Section 05520: Handrails and Railings.
- B. Aluminum Ladders and Cages:

1. Aluminum ladders and cages shall be fabricated from aluminum alloy 6061-T6, or equal. Ladder uprights shall be 3/8-inch by 2 inches and shall be spaced 18 inches apart. Supports shall be 3/8-inch by 2-inch bars bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7 inches from adjacent surfaces and shall be secured to the shotcrete wall by Type 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1-inch diameter, smooth, spaced 12 inches on centers with the ends fitted into and welded to the uprights. Goosenecks shall be provided and anchored to the top of the tank. An approved ladder safety device with aluminum rail and two safety harnesses shall be provided with the ladder, if indicated, which shall be Saf-T-Climb, as manufactured by Norton Company Safety Division, Climbers Buddy Corp., or equal. The ladder, cage and safety device shall be designed, fabricated, and erected in accordance with Part 1910 of the Occupational Safety and Health Standards of the Department of Labor. Provide an aluminum swing out cage gate with padlock brackets.

C. Fiberglass Ladders:

1. Fiberglass ladders shall be completely fabricated of fiberglass reinforced plastic (FRP) structural shapes. Ladder uprights shall be 2-inch square tubing with a 1/8-inch wall thickness and shall be spaced 18-inches apart. Supports shall be 3/8-inch by 2-inch Type 316 stainless steel bars bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7-inches from adjacent surfaces and shall be secured to the shotcrete wall by 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1-inch diameter, solid fiberglass bars, spaced 12-inches on centers with the ends fitted into and bonded to the uprights with epoxy. Fiberglass shapes for ladder fabrication shall be in accordance with Section 06600: Fiberglass Grating and Structural Shapes. An approved ladder safety device with aluminum rail and two safety harnesses shall be provided with the ladder, which shall be Saf-T-Climb as manufactured by Norton Company Safety Division, Climbers Buddy Corporation, or equal. The ladder and safety device shall be designed, fabricated, and erected in accordance with Part 1910 of the Occupational Safety and Health Standards of the Department of Labor.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Excavation and Compaction: Excavation and compaction prior to tank construction shall be in conformance with the applicable requirements of Section 02220: Excavating, Backfilling and Compacting.
- B. Floor:
 1. The completed subgrade shall be wetted to a saturated condition just prior to placement of the concrete floor.
 2. Concrete membrane floors (4-inches thick) shall have a minimum thickness of 8-inches of concrete over all pipe encasements. The minimum percentage, 0.6 percent, of reinforcing steel applies to these thickened sections and shall extend a minimum of 2-feet in to the adjacent 4-inches thick floor.
 3. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

4. The floor shall be sloped to drain with the finishing criteria stated in Section 03300: Cast-in-Place Concrete, except that the finishing tolerance shall be ½-inch in ten feet, as determined by a 10-foot straightedge placed anywhere on the slab in any direction. The floor shall have a light broom finish.
5. Floors shall be continuously water cured until tank construction is completed.

C. Core Wall:

1. The core wall shall be constructed of shotcrete, encasing a steel shell diaphragm continuous the full wall height without horizontal splices. The shotcrete shall be placed in accordance with ACI 506: A Guide to Shotcrete, latest revision.
2. The thickness of the core wall shall be calculated so as to resist the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the core wall be less than 3-1/2 inch thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows.
3. To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall, as a minimum:
 - a. The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.
 - b. The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.
 - c. Inside Face:
 - (1) Vertical reinforcing steel: minimum of #4 bars at 12-inches center to center.
 - (2) Additional vertical and horizontal reinforcing steel as required by design computations.
 - d. Outside Face:
 - (1) Vertical reinforcing steel: minimum of #4 bars at 12-inches center to center.

- (2) Additional vertical and horizontal reinforcing steel bars as required by design computations.

4. Curing:

- a. Interior core wall shall be continuously water cured until prestressing starts.
- b. Exterior core wall shall be continuously water cured until prestressing starts.

5. Tolerances:

- a. Tank Radius: The maximum permissible deviation from the specified tank radius shall not be greater than 0.1 percent of the radius or 60 percent of the core wall thickness, whichever is less.
- b. Vertical Walls: Walls shall be plumb within 3/8-inch per 10 feet of vertical dimension.

D. Steel Shell Diaphragm:

1. A 26 gauge steel tank shell diaphragm, complying with ASTM A366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the core wall, providing a positive waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than 1-inch thick at all places. The steel shell is to be formed and erected such that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices shall not be permitted.
2. All vertical joints in the diaphragm shall be sealed watertight by epoxy injection. This epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell diaphragm has been full encased, inside and outside with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C881, Type III, Grade 1, and shall be 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees Fahrenheit (°F).
3. The steel shell diaphragm design and the epoxy injection procedure shall have been used and proven satisfactory in the ten (10) tanks required for the tank construction company's experience record.

4. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.
5. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.
6. The steel shell diaphragm shall be suitably supported by temporary braces to preclude movement during construction. If the steel shell diaphragm is warm when ready for applications, the steel surfaces shall be sprayed with water for cooling approximately 30 minutes or less before shotcreting and again a few minutes before shotcreting.

E. Shotcrete:

1. All shotcrete shall be placed in accordance with ACI 506, latest revision, and shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with guidelines by ACI Committee 506. Certification shall be accomplished by an independent testing laboratory.
2. Shotcrete mixes, measured by weight, shall be:
 - a. First coat on steel shell diaphragm and prestressing wire: One (1) part cement to three (3) parts fine aggregate.
 - b. All other shotcrete: One (1) part cement to four (4) parts fine aggregate.
3. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm encrusted with overspray.

F. Horizontal Prestressing:

1. Circumferential prestressing of the tank walls shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A648 Class II, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel wire.
2. Placement of the prestressing steel wire to the core wall shall be in a continuous and uniform helix of such pitch as to provide in each lineal

foot of core wall height an initial predetermined force and unit compressive stress equivalent to that shown on the approved shop drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of wire.

3. Areas to be prestressed shall contain not less than ten (10) wires per foot of vertical wall. A maximum of 24 wires per layer per vertical foot will be allowed. Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one (1) wire diameter.
4. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the approved Shop Drawings.
5. No circumferential movement of the wire along the tank wall shall be permitted during or after stressing of the wire. The steel wire bands on the core wall shall be so placed that the prestress "working force" per foot of wall height shall exceed the hydraulic ring tension forces by not less than 5 percent. The "working force" shall be defined as the force determined by multiplying the area of steel wire by the unit wire stress after an allowance for losses of 20,000 psi has been made from the initial unit wire stresses. Such initial unit wire stress readings shall be made the same day the wire is placed, or if made later and after some stress losses have already occurred due to creep of wire, plastic flow and shrinkage of core wall, allowances shall be made for such losses. The clear space between adjacent wires is to be no less than one wire diameter.

G. Measurement of Wire Stress:

1. Equipment shall be supplied at the construction site by the tank construction company to measure tension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic, direct reading, stressometer or other device which can demonstrate not less than 1 percent accuracy; calibrated dynamometers; and a test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

H. Exterior Cover Coat:

1. After circumferential prestressing wires have been placed by the wire winding machine, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete over cover shall have a thickness of no less than 1 inch over the wire. When multiple layers of wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.

I. Wall Openings:

1. When it is necessary for a pipe, access manhole or other appurtenance to pass through the vertical tank wall, the bottom of such appurtenance shall be no less than 18-inches above the floor slab. The prestressing wires required at the pipe or appurtenance elevation shall be distributed equally above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36-inches. All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

J. Shotcrete Finishes:

1. The interior and exterior vertical surfaces of the tank walls shall have a fine, hairbrush broom finish to provide a finely textured, sandy type finish suitable for finish coating. Following finishing, all interior and exterior surfaces of the tank shall be lightly brushed to remove all loose particles of shotcrete or aggregate.

K. Curing of Shotcrete: The finish surfaces of walls shall be cured, starting as soon as possible without damaging surface and not later than two (2) hours after placing, by any of the following methods:

1. Moist-mat cure or moist-cure for the first 48 hours. After completion of moist-mat or moist-cure, an approved membrane curing compound containing a fugitive dye shall be applied in conformance with the membrane material manufacturer's recommendations.
2. Moist-mat cure or moist-cure for seven (7) days.
3. Moist-mat curing shall be moist-curing by covering with at least two (2) layers of burlap, cotton mats, or other approved material. The mat shall be continuously sprayed or intermittently saturated by hosing not less than four (4) times during daylight hours. If intermittently saturated, the mat shall be saturated before 8:30 a.m. and within one and one-half hours of sundown. Saturating of the mat through the night hours will not be

required except as may be directed during hot nights if humidity is low and the breeze is more than 5 mph.

4. Moist-curing shall be accomplished by keeping the surface of the concrete continuously wet with water. Sprinklers or soaker hoses may be used to insure continuous complete water coverage of the concrete surfaces. The sprinklers, soaker hoses or other watering equipment shall be operated 24 hours a day for the duration of the curing period. The duration of the curing period shall be seven (7) days. To ensure that sprinkling water is not blown away by wind from its intended location, special attention shall be given to the number and location of sprinklers so that all concrete surfaces are kept continuously wet. The contractor shall have personnel at the site check the operation of all wetting equipment, the equipment shall be checked out not less than once each daylight hour and once every four hours during the night hours. Daylight hours shall be considered to be from one hour after sunrise to one hour before sundown. The remainder of the day shall be considered night hours.
5. Curing during the multilayered shotcrete construction: The following curing procedures shall be used for any layer of shotcrete that will remain in place more than three (3) hours before the next layer of shotcrete is applied. During hot weather, to reduce cracks caused by quick drying shrinkage, each layer of shotcrete shall be moist-mat cured or moist-cured within one hour after application. The mat, if used, shall be kept moist until it is removed and shall not be removed until just before the next layer of shotcrete is applied. The mat shall be against the shotcrete surface enough to avoid circulation of warm air between the mat and the shotcrete. The exterior surface of the core wall (the surface to receive wire wrapping) shall not receive curing compound, but shall be continuously cured for at least seven (7) days using the moist-mat or moist-cured procedure. In hot weather, the surface of shotcrete shall be fogged as soon as possible after application before other curing methods are started to avoid quick loss of moisture from the fresh shotcreted surface.

3.02 FIELD QUALITY CONTROL

A. Shotcrete Compressive Testing:

1. All tests shall be performed by the tank manufacturer. Each test of shotcrete compressive strength shall consist of the preparation and breaking of five (5) cylinders. The high and low strength cylinders shall not be counted and the strength of the test shall be the average compressive strength in pounds per square inch of the three (3) remaining cylinders.

2. If cylinders are made for determining when wire wrapping can begin, they shall be stored at the site and cured the same as the applicable portion of the structure. All other cylinders shall be removed the next day and stored in a testing laboratory vault similar to standard concrete cylinders. The test cylinders shall be shot with the same mix used in the permanent construction.
3. One test shall be made for each 100 cy of cement, but not less than 2 sets for the inside core wall, 2 sets for the outside core wall, and 2 sets for the over coat. Capping and breaking of cylinders shall be done similarly to standard concrete cylinders and shall be done by a recognized testing laboratory approved by the Engineer.

B. Leakage Testing:

1. Before coatings are applied, each tank shall be slowly filled with water and examined for leakage. Water for leakage testing shall be made available to the contractor by the Owner. Leakage shall be defined as a loss of water. Hydraulic testing of the tank shall be in accordance with the requirements of Section 03800: Leakage Testing of Hydraulic Structures.
2. Launderers for secondary clarifiers shall be tested for leaks by two methods: Method 1 will be by flooding water into the launder to the top of the launder wall, with no water in the tank; Method 2 will be with no water in the launder and with water in the tank up to the top of the launder wall. No leakage in the launder areas will be acceptable. Any leakage detected in the launder areas will be repaired by liquid epoxy injection methods approved by the Engineer.

3.03 PAINTING

- A. All piping, supports, and other ferrous metal surfaces, and interior concrete surfaces of tank walls and tank domes shall be coated following leakage testing in accordance with the applicable requirements of Section 09900: Painting.

3.04 WARRANTY

- A. The tank construction company shall guarantee workmanship and materials on the entire tank structure for a period of five (5) years from date of acceptance of the work. In case leakage or other defects appear within the five (5) year period, the tank construction company shall promptly make repairs at its own expense, upon written notice by the Owner that such defects have been found.

- B. To satisfy the five-year guarantee, acceptable tank construction companies listed under Paragraph 1.02B.3. above shall be required to furnish a written company warranty for the five-year period.
- C. If all experience requirements cannot be met as described in Paragraphs 1.02B.1. and 1.02B.2., an additional bond shall be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
- D. Leakage is defined as the stream flow of liquid appearing on the exterior surface of the tank, or leakage through the base slab, the source of which is from the inside of the tank. Leakage shall be determined by leakage testing as defined in Section 03800, Leakage Testing of Hydraulic Structures.

END OF SECTION

SECTION 13202

RECTANGULAR PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Requirements specified in Conditions of Contract and Division 1: General Requirements form a part of this Section. Provide for the design and construction of the following rectangular prestressed concrete tanks: one (1), 48' x 10' x 10' equalization tank and two (2), 40' x 25' x 20' sequence batch reactor tanks. Tanks must conform to the dimensions and locations shown on the Drawings. The tank construction company shall furnish all engineering services, including subsurface geotechnical investigation, required for the preparation of design calculations and detailed design drawings, and furnish all materials, labor and equipment for the construction of the prestressed tank as shown on the Drawings and as specified herein.
2. The prestressed concrete tanks shall be of composite steel-shotcrete, wire-wound, prestressed construction. The wire-wound prestressed composite wall shall include a shotcrete core wall in which a steel shell diaphragm of a height equal to the full wall height has been encased. All prestressing shall be done with high tensile wire permanently bonded to the tank wall. The tank floor shall be of concrete or shotcrete construction containing no less than 0.6 percent of reinforcing steel.

B. Related Work Described Elsewhere:

1. Excavation, Backfilling and Compaction: Section 02220.
2. Concrete Reinforcement: Section 03200.
3. Cast-In-Place Concrete: Section 03300.
4. Leakage Testing of Hydraulic Structures: Section 03800.
5. Structural Aluminum: Section 05140.
6. Metal Fabrication: Section 05500.

7. Handrails and Railing: Section 05520.
8. Aluminum Grating System: Section 05530.
9. Fabricated Fiberglass Reinforced Plastic Products: Section 06605
10. Painting: Section 09900.
11. Process and Utility Piping, Fittings, Valves and Accessories: Section 15050.

C. General Design

1. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.
2. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.
3. All prestressing shall be done with high tensile steel wire in which a substantial allowance shall be made for loss of prestress due to shrinkage and plastic flow in the shotcrete and to relaxation in the steel wire and diaphragm.
4. Size and Configuration of Tank: The dimensions of the prestressed circular concrete tanks including the floor slopes, sumps, tank diameters and vertical wall heights shall be as indicated on the Drawings.
5. Design of the prestressed tanks shall accommodate the following differential and total settlements. As outlined in the attached geotechnical soils report.

- D. The contractor shall be responsible for coordinating all activities between the prestressed concrete tank manufacturer required for a complete installation. Activities requiring extensive coordination would include but not be limited to shop drawing submittals, embedded items required to be installed during construction of the prestressed concrete tank. Construction of the prestressed concrete tank shall not commence until all key dimensions, equipment and pipe locations, and any other interdependent items are approved by the Engineer, and any conflicts or ambiguities are resolved. It shall remain the contractor's sole responsibility to resolve any errors or conflicts arising during construction due to improper coordination between the prestressed concrete tank construction company.

1.02 QUALITY ASSURANCE

- A. Design Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the following standards, latest revisions.
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 2. ACI 301: Specifications for Structural Concrete for Buildings.
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 4. ACI 506R-85: Guide to Shotcrete.
 5. ACI 344: Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures.
- B. Qualifications and Experience of Tank Construction Company: The tank construction company shall have the following qualifications and experience:
1. The tank construction company shall specialize in the design and construction of wire-wound circular prestressed composite steel-concrete tanks. The tank construction company shall give satisfactory evidence that it has the skill, reliability and financial stability to design, build and guarantee the tank in accordance with the quality required by these specifications. The tank construction company shall have at least ten (10) years experience in this specialty and shall have built completely in its own name in the past five years no less than ten (10) prestressed composite tanks of comparable size, which meet these specifications and are now demonstrating satisfactory service. If all experience requirements cannot be met, an additional bond will be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
 2. The tank construction company staff shall include a full-time Professional Engineer registered in the State of Florida having no less than ten (10) years experience in the design and field construction of circular prestressed composite tanks who will be the responsible engineer in charge of the work to be done. All Working Drawings and design calculations shall carry the seal of such registered Professional Engineer.
 3. Acceptable Tank Manufacturer: The tank shall be as manufactured by the Crom Corporation, Gainesville, Florida; Precon Corporation, Newberry, Florida, or approved equal.

Any other tank construction company wishing to be considered shall submit a record of its experience in the design and construction of the type of tank

proposed for this project, including a list of the ten (10) tanks of the proposed size or larger now in service. Qualification data shall be submitted to the Engineer prior to 15 days before the date set for the receipt of bids. Any tank construction company considered acceptable will be notified prior to the bid date by the Engineer. Tank construction companies not pre-qualified prior to the bid shall not be considered.

B. Design Criteria: To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall:

1. The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.
2. The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.
3. Inside Face:
 - a. 26-gauge steel shell diaphragm continuous the full wall height, without horizontal splices.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
4. Outside Face:
 - a. Vertical reinforcing steel: Minimum of #4 bars at 12-inch center to center.
 - b. Additional vertical and horizontal reinforcing steel bars as required by design computations.
5. Allowable Tensile Stress f_s 18,000 psi
Yield Strength f_y 40,000 psi
6. Design Loads: Wind loads, including uplift and overturning shall be as required by the Standard Building Code and any local amendments to the Code.
7. Qualifications of Workmen: The foreman, nozzle men, and gun men shall be skilled in their duties and certified in accordance with the guidelines by ACI Committee 506 Certification, latest revision. The contractor shall submit the names of the men performing the above duties, with a statement of certification as to their qualifications. Certification will be

accomplished by a recognized authority such as ELF/FC&PA*, ACI, or approved equal.

*ELF - Engineering Laboratory Forum, Florida Institute
of Consulting Engineers
FC&PA - Florida Concrete and Products Association

1.03 SUBMITTALS

- A. Shop Drawings: The Contractor shall submit a complete set of detailed shop drawings signed and sealed by a Florida Registered Professional Engineer for the work to be done. Inside dimensions, pipe openings and provisions for mechanical equipment shall be maintained as established by the Engineer. Shop drawings must be approved before construction may begin.
- B. Design Computations: The Contractor shall submit complete design computations. The design shall be done under the direction of a Florida Registered Professional Engineer and shall be signed or sealed by name of the design engineer. The design computations shall include all components of the tank, including wall, cantilevered launders, floor and sumps, wall penetrations, pipe supports, the wall reaction to the bottom slab, and the loads imposed by concrete dome covers. The design shall include consideration of temperature differentials under various conditions, stresses at wire winding and completed stages with tank empty and full, flexure in walls and base, anticipated movement of base under circumferential wire stresses, special stresses at wire anchorages and a construction procedure listing in chronological order the various operations of construction. The design computations shall be submitted for approval at least 30 days before the materials are assembled at the job site.
- C. Shop drawings shall be submitted showing complete details, dimensions, materials, fastenings, anchorages and special details of wall reinforcement at attachment of accessories and details of interior launder construction.
- D. If a sliding waterstop is used in the floor/wall joint, submit load/shear/deflection data to support shear and deflection calculations for base of wall. Tests shall have been generated for the particular waterstop configuration proposed.
- E. Submit to the Engineer, a guarantee document as specified in Paragraph 1.04, herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete

1. Concrete shall have a 28 day compressive strength of 4000 psi and shall be in conformance with the requirements of Section 03300: Cast-in-Place Concrete. Cement shall be Type II.

B. Shotcrete: Shall be in accordance with ACI Standard 506, latest revision, except as indicated otherwise herein. Proportions for all shotcrete shall be one part cement to 4 parts moist sand by weight, except that proportions of 1 to 3 shall be used for the cover coat on each side of the steel shell diaphragm and over the wire wrapping; these richer cover coats shall be at least 1/4-inch thick (measured from the outside of the wire for wire wrapping coat). Sand shall be composed of hard, strong, durable, uncoated grains of quartz in accordance with gradation limits in ACI 506, except that the fineness modulus may be reduced to 2.0.

1. Compressive strength (f_g) shall be 4000 psi or greater at 28 days.
2. Allowable compressive stress (f_g) shall be determined by the formula $1250 + 75t$ with $0.45 f_g$ maximum where t is the core wall thickness.
3. Allowable compressive stress (f_g) due to initial prestressing force shall be $0.50 f_{gi}$ or less, with a minimum of 2000 psi, where f_{gi} is defined as compressive strength at time initial prestressing force is applied.
4. Cement shall be in accordance with the requirements of Section 03300: Cast-in-Place Concrete. Cement shall be Type II.

C. Prestressing Wire:

1. Cold drawn, high-carbon steel wire complying with ASTM A-648 Class II.
2. Wire size shall be 0.162-inch diameter (8 gauge) or larger, but no larger than 0.250-inch.
3. Working stress for wire in the wall (f_s) shall be 115,000 psi.
4. Allowable tensile stress before losses (f_{is}) shall be 145,000 psi or no greater than $0.70 f_s$.
5. Ultimate tensile strength (f_{su}) shall be 231,000 psi or greater.

D. Reinforcing Bars:

1. In conformance with ASTM A615, Grade 60, and with the requirements of Section 03200: Concrete Reinforcement.
 2. Floor slab bar supports shall be reinforced steel bolster.
- E. Wire Fabric Reinforcement:
1. Welded wire fabric shall conform to ASTM A185: Welded Wire Fabric for Concrete Reinforcement. Wire fabric shall be electrically welded and galvanized wire. Welded wire fabric shall be furnished in flat sheets; rolled WWF is not permitted.
 2. Welded wire fabric supports shall be plastic tipped bolsters with bar ties galvanized precast concrete blocks.
- F. Steel Shell Diaphragm:
1. Steel tank shell diaphragm shall be cold rolled sheet, minimum 26-gauge, conforming to ASTM A366 for Commercial Quality Cold Rolled Steel, with a Class 2, rolled finish or approved equal.
- G. PVC waterstops shall have minimum thickness of 3/8-inch in areas exposed to hydraulic loads.

2.02 ACCESSORIES

- A. Aluminum Handrails, Platforms and Grating:
1. Aluminum platforms shall be designed to support the intended live and dead loads with a minimum factor of safety of 2.0. The maximum deflection for platforms shall be limited to a maximum of 1:360 of the maximum span. Aluminum used for fabrication shall be structural aluminum shapes in accordance with Section 05140: Structural Aluminum, and Section 05500: Metal Fabrications. Aluminum grating used for platforms shall be in accordance with Section 05530: Aluminum Grating System. Aluminum handrailing installed around the dome access hatch and the aluminum access platforms shall be a three rail type handrail system, with a 4-inch toe board. Handrailing shall be constructed of 1 1/2-inch (1.90" o.d.), Schedule 40 aluminum pipe, Alloy 6063-T6, in accordance with Section 05520: Handrails and Railings.
- B. Aluminum Ladders and Cages:
1. Aluminum ladders and cages shall be fabricated from aluminum alloy 6061-T6, or equal. Ladder uprights shall be 3/8-inch by 2 inches and shall

be spaced 18 inches apart. Supports shall be 3/8-inch by 2-inch bars bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7 inches from adjacent surfaces and shall be secured to the shotcrete wall by Type 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1-inch diameter, smooth, spaced 12 inches on centers with the ends fitted into and welded to the uprights. Goosenecks shall be provided and anchored to the top of the tank. An approved ladder safety device with aluminum rail and two safety harnesses shall be provided with the ladder, if indicated, which shall be Saf-T-Climb, as manufactured by Norton Company Safety Division, Climbers Buddy Corp., or equal. The ladder, cage and safety device shall be designed, fabricated, and erected in accordance with Part 1910 of the Occupational Safety and Health Standards of the Department of Labor. Provide an aluminum swing out cage gate with padlock brackets.

C. Fiberglass Ladders:

1. Fiberglass ladders shall be completely fabricated of fiberglass reinforced plastic (FRP) structural shapes. Ladder uprights shall be 2-inch square tubing with a 1/8-inch wall thickness and shall be spaced 18-inches apart. Supports shall be 3/8-inch by 2-inch Type 316 stainless steel bars bent to shape and shall be spaced not over 5 feet apart. Ladders shall be rigidly supported not less than 7-inches from adjacent surfaces and shall be secured to the shotcrete wall by 316 stainless steel bolts embedded in the shotcrete during construction of the wall. Rungs shall be not less than 1-inch diameter, solid fiberglass bars, spaced 12-inches on centers with the ends fitted into and bonded to the uprights with epoxy. Fiberglass shapes for ladder fabrication shall be in accordance with Section 06600: Fiberglass Grating and Structural Shapes. An approved ladder safety device with aluminum rail and two safety harnesses shall be provided with the ladder, which shall be Saf-T-Climb as manufactured by Norton Company Safety Division, Climbers Buddy Corporation, or equal. The ladder and safety device shall be designed, fabricated, and erected in accordance with Part 1910 of the Occupational Safety and Health Standards of the Department of Labor.

PART 3 - EXECUTION

3.01 CONSTRUCTION

- A. Excavation and Compaction: Excavation and compaction prior to tank construction shall be in conformance with the applicable requirements of Section 02220: Excavating, Backfilling and Compacting.

B. Floor:

1. The completed subgrade shall be wetted to a saturated condition just prior to placement of the concrete floor.
2. Concrete membrane floors (4-inches thick) shall have a minimum thickness of 8-inches of concrete over all pipe encasements. The minimum percentage, 0.6 percent, of reinforcing steel applies to these thickened sections and shall extend a minimum of 2-feet in to the adjacent 4-inches thick floor.
3. Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.
4. The floor shall be sloped to drain with the finishing criteria stated in Section 03300: Cast-in-Place Concrete, except that the finishing tolerance shall be ½-inch in ten feet, as determined by a 10-foot straightedge placed anywhere on the slab in any direction. The floor shall have a light broom finish.
5. Floors shall be continuously water cured until tank construction is completed.

C. Core Wall:

1. The core wall shall be constructed of shotcrete, encasing a steel shell diaphragm continuous the full wall height without horizontal splices. The shotcrete shall be placed in accordance with ACI 506: A Guide to Shotcrete, latest revision.
2. The thickness of the core wall shall be calculated so as to resist the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the core wall be less than 3-1/2 inch thick.
3. To compensate for bending moments and for shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall, as a minimum:
 - a. The top 2 feet of core wall shall have not less than 1 percent reinforcing.
 - b. The bottom 3 feet of core wall shall have not less than 1 percent reinforcing.

c. Inside Face:

- (1) Vertical reinforcing steel: minimum of #4 bars at 12-inches center to center.
- (2) Additional vertical and horizontal reinforcing steel as required by design computations.

d. Outside Face:

- (1) Vertical reinforcing steel: minimum of #4 bars at 12-inches center to center.
- (2) Additional vertical and horizontal reinforcing steel bars as required by design computations.

4. Curing:

- a. Interior core wall shall be continuously water cured until prestressing starts.
- b. Exterior core wall shall be continuously water cured until prestressing starts.

5. Tolerances:

- a. Tank Dimensions: The maximum permissible deviation from the specified tank dimensions shall not be greater than 0.1 percent of the radius or 60 percent of the core wall thickness, whichever is less.
- b. Vertical Walls: Walls shall be plumb within 3/8-inch per 10 feet of vertical dimension.

D. Steel Shell Diaphragm:

1. A 26 gauge steel tank shell diaphragm, complying with ASTM A366 for Commercial Quality Cold Rolled Steel, shall be used within and throughout the core wall, providing a positive waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than 1-inch thick at all places. The steel shell is to be formed and erected such that a mechanical key between shotcrete and diaphragm will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices shall not be permitted.

2. All vertical joints in the diaphragm shall be sealed watertight by epoxy injection. This epoxy injection shall be carried out from bottom of wall to top of wall, using a pressure pumping procedure, after the steel shell diaphragm has been full encased, inside and outside with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C881, Type III, Grade 1, and shall be 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees Fahrenheit (°F).
3. The steel shell diaphragm design and the epoxy injection procedure shall have been used and proven satisfactory in the ten (10) tanks required for the tank construction company's experience record.
4. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.
5. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.
6. The steel shell diaphragm shall be suitably supported by temporary braces to preclude movement during construction. If the steel shell diaphragm is warm when ready for applications, the steel surfaces shall be sprayed with water for cooling approximately 30 minutes or less before shotcreting and again a few minutes before shotcreting.

E. Shotcrete:

1. All shotcrete shall be placed in accordance with ACI 506, latest revision, and shall be applied by or under direct supervision of experienced nozzlemen certified in accordance with guidelines by ACI Committee 506. Certification shall be accomplished by an independent testing laboratory.
2. Shotcrete mixes, measured by weight, shall be:
 - a. First coat on steel shell diaphragm and prestressing wire: One (1) part cement to three (3) parts fine aggregate.
 - b. All other shotcrete: One (1) part cement to four (4) parts fine aggregate.

3. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm encrusted with overspray.

F. Horizontal Prestressing:

1. Prestressing of the tank walls shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A648 Class II, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel wire.
2. Placement of the prestressing steel wire to the core wall shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial predetermined force and unit compressive stress equivalent to that shown on the approved shop drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire, or when removing a defective section of wire.
3. Areas to be prestressed shall contain not less than ten (10) wires per foot of vertical wall. A maximum of 24 wires per layer per vertical foot will be allowed. Shotcrete shall be used to completely encase each individual wire, and protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one (1) wire diameter.
4. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the approved Shop Drawings.
5. No circumferential movement of the wire along the tank wall shall be permitted during or after stressing of the wire. The steel wire bands on the core wall shall be so placed that the prestress "working force" per foot of wall height shall exceed the hydraulic ring tension forces by not less than 5 percent. The "working force" shall be defined as the force determined by multiplying the area of steel wire by the unit wire stress after an allowance for losses of 20,000 psi has been made from the initial unit wire stresses. Such initial unit wire stress readings shall be made the same day the wire is placed, or if made later and after some stress losses have already occurred due to creep of wire, plastic flow and shrinkage of core

wall, allowances shall be made for such losses. The clear space between adjacent wires is to be no less than one wire diameter.

G. Measurement of Wire Stress:

1. Equipment shall be supplied at the construction site by the tank construction company to measure tension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic, direct reading, stressometer or other device which can demonstrate not less than 1 percent accuracy; calibrated dynamometers; and a test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.

H. Exterior Cover Coat:

1. After circumferential prestressing wires have been placed by the wire winding machine, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bond the wire to the tank wall. The shotcrete over cover shall have a thickness of no less than 1 inch over the wire. When multiple layers of wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.

I. Wall Openings:

1. When it is necessary for a pipe, access manhole or other appurtenance to pass through the vertical tank wall, the bottom of such appurtenance shall be no less than 18-inches above the floor slab. The prestressing wires required at the pipe or appurtenance elevation shall be distributed equally above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36-inches. All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

J. Shotcrete Finishes:

1. The interior and exterior vertical surfaces of the tank walls shall have a fine, hairbrush broom finish to provide a finely textured, sandy type finish suitable for finish coating. Following finishing, all interior and exterior surfaces of the tank shall be lightly brushed to remove all loose particles of shotcrete or aggregate.

K. Curing of Shotcrete: The finish surfaces of walls shall be cured, starting as soon as possible without damaging surface and not later than two (2) hours after placing, by any of the following methods:

1. Moist-mat cure or moist-cure for the first 48 hours. After completion of moist-mat or moist-cure, an approved membrane curing compound containing a fugitive dye shall be applied in conformance with the membrane material manufacturer's recommendations.
2. Moist-mat cure or moist-cure for seven (7) days.
3. Moist-mat curing shall be moist-curing by covering with at least two (2) layers of burlap, cotton mats, or other approved material. The mat shall be continuously sprayed or intermittently saturated by hosing not less than four (4) times during daylight hours. If intermittently saturated, the mat shall be saturated before 8:30 a.m. and within one and one-half hours of sundown. Saturating of the mat through the night hours will not be required except as may be directed during hot nights if humidity is low and the breeze is more than 5 mph.
4. Moist-curing shall be accomplished by keeping the surface of the concrete continuously wet with water. Sprinklers or soaker hoses may be used to insure continuous complete water coverage of the concrete surfaces. The sprinklers, soaker hoses or other watering equipment shall be operated 24 hours a day for the duration of the curing period. The duration of the curing period shall be seven (7) days. To ensure that sprinkling water is not blown away by wind from its intended location, special attention shall be given to the number and location of sprinklers so that all concrete surfaces are kept continuously wet. The contractor shall have personnel at the site check the operation of all wetting equipment, the equipment shall be checked out not less than once each daylight hour and once every four hours during the night hours. Daylight hours shall be considered to be from one hour after sunrise to one hour before sundown. The remainder of the day shall be considered night hours.
5. Curing during the multilayered shotcrete construction: The following curing procedures shall be used for any layer of shotcrete that will remain in place more than three (3) hours before the next layer of shotcrete is applied. During hot weather, to reduce cracks caused by quick drying shrinkage, each layer of shotcrete shall be moist-mat cured or moist-cured within one hour after application. The mat, if used, shall be kept moist until it is removed and shall not be removed until just before the next layer of shotcrete is applied. The mat shall be against the shotcrete surface enough to avoid circulation of warm air between the mat and the shotcrete. The exterior surface of the core wall (the surface to receive wire wrapping) shall not receive curing compound, but shall be continuously cured for at least seven (7) days using the moist-mat or moist-cured procedure. In hot weather, the surface of shotcrete shall be fogged as soon

as possible after application before other curing methods are started to avoid quick loss of moisture from the fresh shotcreted surface.

3.02 FIELD QUALITY CONTROL

A. Shotcrete Compressive Testing:

1. All tests shall be performed by the tank manufacturer. Each test of shotcrete compressive strength shall consist of the preparation and breaking of five (5) cylinders. The high and low strength cylinders shall not be counted and the strength of the test shall be the average compressive strength in pounds per square inch of the three (3) remaining cylinders.
2. If cylinders are made for determining when wire wrapping can begin, they shall be stored at the site and cured the same as the applicable portion of the structure. All other cylinders shall be removed the next day and stored in a testing laboratory vault similar to standard concrete cylinders. The test cylinders shall be shot with the same mix used in the permanent construction.
3. One test shall be made for each 100 cy of cement, but not less than 2 sets for the inside core wall, 2 sets for the outside core wall, and 2 sets for the over coat. Capping and breaking of cylinders shall be done similarly to standard concrete cylinders and shall be done by a recognized testing laboratory approved by the Engineer.

B. Leakage Testing:

1. Before coatings are applied, each tank shall be slowly filled with water and examined for leakage. Water for leakage testing shall be made available to the contractor by the Owner. Leakage shall be defined as a loss of water. Hydraulic testing of the tank shall be in accordance with the requirements of Section 03800: Leakage Testing of Hydraulic Structures.
2. Launderers for secondary clarifiers shall be tested for leaks by two methods: Method 1 will be by flooding water into the launder to the top of the launder wall, with no water in the tank; Method 2 will be with no water in the launder and with water in the tank up to the top of the launder wall. No leakage in the launder areas will be acceptable. Any leakage detected in the launder areas will be repaired by liquid epoxy injection methods approved by the Engineer.

3.03 PAINTING

- A. All piping, supports, and other ferrous metal surfaces, and interior concrete surfaces of tank walls and tank domes shall be coated following leakage testing in accordance with the applicable requirements of Section 09900: Painting.

3.04 WARRANTY

- A. The tank construction company shall guarantee workmanship and materials on the entire tank structure for a period of five (5) years from date of acceptance of the work. In case leakage or other defects appear within the five (5) year period, the tank construction company shall promptly make repairs at its own expense, upon written notice by the Owner that such defects have been found.
- B. To satisfy the five-year guarantee, acceptable tank construction companies listed under Paragraph 1.02B.3. above shall be required to furnish a written company warranty for the five-year period.
- C. If all experience requirements cannot be met as described in Paragraphs 1.02B.1. and 1.02B.2., an additional bond shall be required. This bond shall be in effect for four (4) years after expiration of the standard one (1) year performance bond and shall warrant the tank to be free of defects in materials and workmanship.
- D. Leakage is defined as the stream flow of liquid appearing on the exterior surface of the tank, or leakage through the base slab, the source of which is from the inside of the tank. Leakage shall be determined by leakage testing as defined in Section 03800, Leakage Testing of Hydraulic Structures.

END OF SECTION

SECTION 13600

INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 SCOPE

- A. In general, the work specified in this section includes the furnishing of all labor, material, and services necessary to install the Instrumentation system, including all fees, charges and permits necessary. All of the instruments and programming shall be supplied by one company. The contractor shall employ an Instrument Systems Integrator to be responsible for the instrumentation, auto dialer, and SCADA system.
- B. The Contractor shall make all interconnections required between transmitters, receivers, recorders, indicating instruments, control panels and miscellaneous devices and shall provide for electrical supply to metering and signal systems. All conduit and wiring between electrical and instrumentation panels, all field-mounted devices, and power sources shall be furnished and installed as required for a complete operable system.
- C. The instrument locations and conduit drawings are diagrammatic to show the general scope and route of instrumentation conduit. The Contractor shall provide all conduit and wiring necessary for his specific requirements, in accordance with these specifications, and without additional cost to the Owner.

1.2 GENERAL REQUIREMENTS

- A. It is the intent of these specifications that the Contractor furnish the control systems indicated and that they be ready for the intended duty. The Specifications enumerated below may make reference to manufacturers to establish quality. Substitutions will be allowed in accordance with the provisions of the GENERAL CONTRACT CONDITIONS except the instruments noted as "no equal". Acceptance of alternate equipment does not relieve the Contractor of the responsibility of compliance with the performance and accuracy requirements of these specifications.
 - 1. Where such substitutions alter the design or space requirements indicated on the Contract Drawings, detailed drawings shall be prepared and submitted by the Contractor delineating any changes in or additions to the work shown on the contract drawings, and such drawings and changes or additions to the work shall be made by the Contractor at no additional expense to the Owner. In all cases, the burden of proof that the material or

equipment offered for substitution is equal in construction, efficiency, and service to that named on the Contract Drawings and in these Contract Documents shall rest on the Contractor and, unless the proof is satisfactory to the Engineer, the substitution will not be approved.

- B. Equipment Limitation – All equipment furnished under this section of the specifications shall be new and unused and shall be the standard product of manufacturers regularly engaged in the production of such equipment. Wherever possible, equipment items having the same or similar rated capacity or function shall be identical.
- C. Submissions. The Contractor shall submit seven copies of submittal data for approval prior to releasing any of the equipment items specified in this section for delivery or fabrication
 - 1. Shop drawing submittals shall include the following:

A detailed system loop diagram showing all connections required between component parts of each system and between the various systems specified. The loop wiring connection diagram shall show all of the components with the individual electrical terminal blocks numbered and piping connections tagged with identifying numbers. Tabulated wiring number sheets and terminal block numbering sheets will not be accepted. Each wire shall be identified by number on the as-built copies of these connection diagrams and furnished to the Owner as part of the O&M Manuals.
- D. Operation and maintenance manuals, in accordance with the provisions of the GENERAL CONDITIONS, shall also be supplied. Operating and Maintenance instructions shall be supplied for each component of the instrumentation system in one 3-ring binder with a suitable index for locating the applicable manual for each component. The model numbers of the instruments supplied will be tabulated for a cross-reference so that the applicable sections of the maintenance manuals can be determined. A list of manufacturer's recommended spare parts list shall be provided for each instrument. Any special calibration or maintenance requirements peculiar to this system shall be clearly defined.
- E. Tagging. All components shall be tagged with the tag number and nomenclature given in the specifications.
- F. Guarantee. The Contractor shall furnish to the Owner a written one year guarantee covering material and workmanship for all equipment and parts supplied under this section of the specifications. The guarantor will, upon notice, without undue delay, and without expense to the Owner, repair or replace any equipment considered defective by the Engineer within this period. The one year guarantee period will be extended on repaired or replaced parts to one year from the date of acceptance of the repaired or replaced parts.

1.3. GENERAL DESIGN CRITERIA

- A. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the instrumentation system.
- B. All electrical components of the system shall operate on 120 VAC, 1 phase, 60 hertz power. If the equipment supplied requires other power; power supplies or conditioners shall be supplied by the contractor.

1.4 CONTROL SYSTEM

- A. Influent Headworks Structure:

Two (2) influent lines will be entering the headworks. Two (2) sonic time-of-flight flow meters will be installed, one in each of these lines and the signals wired to the main SCADA for the recording of the total influent flow.
- B. SBR:

The sensing/detection devices and PLC-based control panels necessary for the SBR operations will be provided by the SBR supplier. The control parameters include, but not limited to water level, timer, and dissolved oxygen (DO) meter/controllers. All signals from these panels shall be connected to the central SCADA system.
- C. SBR Effluent Equalization (EQ) Tank:
 - 1. Necessary number of float switches shall be installed in this tank and connected to, or otherwise incorporated into the main control system to accomplish the following functions:
 - a. High-High level (90% height) in EQ tank to deactivate SBR decanter (i.e., stop discharging of effluent from SBR)
 - b. Permissive Level (60% height) in EQ tank to resume SBR decanter (i.e., allow discharging of effluent from SBR as necessary)
 - c. High level (80% height) in EQ tank to turn on the SBR EQ effluent pump, chlorination pump, and chemical feed pump
 - d. Low level (20% height) in EQ tank to shut off the SBR EQ effluent pump, chlorination pump, and chemical feed pump
- D. Automatic Backwashed Filters:
 - 1. The sensors and PLC-based control panels necessary for the automatic backwashed filters operations will be provided by the filter manufacturer. All signals and operation parameters from these panels shall be connected to the central SCADA system.

2. One (1) turbidity meter/controller shall be installed in the effluent of the filters for turbidity measurement. A sample pump shall be installed in the line after the filters with the sample being pumped back to the top of the filter structure and the excess discharged back in to the filter. The signals from the turbidity meter shall be incorporated into the SCADA and connected to the main control system to function as follows:
 - a. When the plant is operated in the regular mode, set High limit at 3.0 NTU to shut off SBR EQ effluent pump and activate audio and visual alarms.
 - b. When the plant is operated in the high level disinfection mode, set High limit at 12.0 NTU to shut off SBR EQ effluent pump and activate audio and visual alarms.

E. Chlorine Contact Chamber (CCC) Effluent Wet Well:

1. Necessary number of float switches shall be installed at the wet well and connected to, or otherwise incorporated into the main control system to accomplish the following functions:
 - a. High-High level (90% height) to cut off power to the SBR EQ effluent pump
 - b. High level (80% height) to turn on CCC wet well effluent pump
 - c. Permissive Level (60% height) for SBR EQ effluent pumps on
 - d. Low level (20% height) for CCC wet well effluent pump off
2. One (1) chlorine analyzer shall be installed in this wet well for continuous residual chlorine concentration monitoring. The signals from this analyzer shall be incorporated into the SCADA and connected to the main control system to function as follows:
 - a. When the plant is operated in the regular mode, set Low limit at 0.55 mg/L to shut off CCC wet well effluent pump, activate audio and visual alarms, and activate autodialer to programmable telephone numbers.
 - b. When the plant is operated in the high level disinfection mode, set Low limit at 0.11 mg/L to shut off CCC wet well effluent pump and activate audio and visual alarms, and activate autodialer to programmable telephone numbers.
3. One (1) sonic time-of-flight flow meter will be installed in the effluent line and the signal wired to the main SCADA for the recording of the total effluent flow.

F. Ground Storage Tank (GST):

1. Necessary number of float switches shall be installed at the GST and connected to, or otherwise incorporated into the main control system to accomplish the following functions:
 - a. High-High level (90% height) to cut off power to CCC wet well effluent pump
 - b. High level (80% height) to turn on the sprayfield pump
 - c. Permissive Level (60% height) to turn on CCC wet well effluent pumps
 - d. Low level (10% height) to cut off sprayfield pump

G. Chlorine Feed Pump and Storage:

1. The chlorine skid being installed in sections 11260 at the chlorine building shall be monitored and paced from the SCADA system.
2. One (1) low level switch shall be installed in the chlorine storage tank to activate the audio and visual alarms and autodialer when the liquid level in the tank reaches 20% of the tank capacity.
3. One (1) high float switch shall be installed in the chlorine storage tank secondary containment area level (30% height) to activate the audio and visual alarms and autodialer when the liquid is detected in this area.
4. The chlorine feed pump operations shall be synchronized with the CCC wet well effluent pump operations.

H. Chemical Feed Pump #1 (Alkali Feed Pump):

1. The chemical feed pump shall be monitored and paced from the SCADA system.
2. One (1) low level switch shall be installed in the alkali storage tank to activate the audio and visual alarms and autodialer when the liquid level in the tank reaches 20% of the tank capacity.
3. The power to Chemical Feed Pump #1 shall be synchronized with the SBR circulation pump operations.

I. Chemical Feed Pump #2 (Ferric Chloride Feed Pump):

1. The chemical feed pump shall be monitored and paced from the SCADA system.
2. One (1) low level switch shall be installed in the ferric chloride storage tank to activate the audio and visual alarms and autodialer when the liquid level in the tank reaches 20% of the tank capacity.

3. The power to Chemical Feed Pump #2 shall be synchronized with the CCC wet well effluent pump operations.

PART 2 – MATERIALS AND EQUIPMENT

2.1 INSTRUMENT COMPONENTS

A. Sonic Influent Flow Meter

The sonic flow meter shall be a strap-on time of flight meter with a remote mounted signal converter with the following specifications:

Flow Sensor: Range 4"-160" pipe diameter

Housing: NEMA 4X

Sensor Cable: 10m/30ft

Housing: Remote, wall mounted, Aluminum, IP67 NEMA4X

Power: 120 VAC

Output: 4-20mA HART + frequency

The flow meter shall be an Endress + Hauser Prosonic Flow 90WA0 Clamp On, Ultrasonic flow meter Model: PC 90WA0-AB2B20ACBAAA with a Model: DK8WM-A Transmitter 80/83/84, mounting set, or equal.

B. Level Switch

The level switches shall be mercury-free, suspended, tilt type switches with an internal weight. The float housing shall be polypropylene, with a SPDT switch, minimum rating of 5A @ 120 VAC. The float switches shall be an Anchor Scientific Model GSI 50NONC, or approved equal

C. Turbidity Analyzer

The turbidimeter shall be a microprocessor based continuous reading on-line nephelometric instrument. The turbidimeter shall measure turbidity in the range of 0.001 – 100 NTU. Accuracy shall be $\pm 2\%$ of reading or ± 0.015 NTU from 0 to 40 NTU. Displayed resolution shall be 0.0001 NTU from 9 to 9.999 NTU. Repeatability shall be better than $\pm 1.0\%$ of reading or ± 0.002 NTU (whichever is greater). The turbidimeter body shall be constructed of corrosion resistant material and shall include an internal bubble removal system. The remote mounted interface unit shall include two analog outputs and three unpowered SPDT alarm contacts. The interface system shall allow the operators to control sensor and interface functions with menu-driven software. The interface power shall be 120 VAC.

The Turbidity Analyzer System shall consist of Hach Company:

1 pc. Model: 1720E Low Range Process Turbidimeter

1 pc. Model PS1201 Power Supply

1 pc. Model 51350 Aquatrend/SOM Interface, or equal

The turbidity analyzer system shall be mounted on a suitable backboard or frame assembly to allow piping per the manufacturer's instructions. The converter shall be mounted in a suitable sunshield.

D. Pressure Transmitter

The pressure transmitter shall be a 2 wire, indicating, strain gage, intelligent transmitter with the following features:

Range Calibrated to 0 - 150 PSIG

Output: 4 - 20 maDC Max Load Minimum 550 ohms

316 St. Steel diaphragm

Accuracy $\pm$.25% of span

Aluminum Housing NEAM 4

316L St. Steel Sensor & Process Connection Material

Fill material Silicon

Digital Indicator Programmable in Engineering Units

Pushbutton Configuration, No external configurator needed.

Adjustable Zero & Span Settings

Adjustable Damping

The pressure transmitter shall be Foxboro Model IGP10 or equal.

E. SCADA System Equipment:

The RTU shall have the following:

1. NEMA 4X, St. Steel Enclosure

1 pc. Modicon Momentum PLC Assembly consisting of:

1 pc. Model: 170ADM35010 Base with 16 digital inputs; 24 VDC

16 digital outputs; 24 VDC

1 pc. Model 171CCS76000 Processor Adapter

1 pc. Model 170XTS00100 Bus Bar

1 pc. Advantech ADAM-6541-ST/M Ethernet to Fiber Optic Converter

1 pc. 120 VAC/24 VDC power supply

1 pc. 500 VA Uninterruptible power supply with built-in surge protection.

1 pc. 900 MHZ radio transceiver Microwave Data Systems Transnet 900 Spread Spectrum Radio or equal.

Lot OMNI antenna and accessories to transmit 900 MHZ signal with lightning surge arrestors as required.

F. SCADA Radio Telemetry System Programming:

The SCADA telemetry shall be capable of displaying graphic screens, trending and control required to accomplish the operations detailed above. The software used for the programming shall be provided by the contractor. After start up, testing, and checkout; the program shall be given to the Owner on a CD and in a printout manual along with all I/O lists and notes in detail.

G. Auto Dialer:

The auto dialer shall be capable of calling, through regular telephone lines, to a minimum of four (4) selected telephone numbers and provide voice messages for at least eight (8) different operation scenarios. It shall allow call recipients to respond as necessary and allows users to call in to monitor situation. Acceptable manufacturers include Microtel Inc., Everspring Industry Co., and Aeonstar Technology Corp.

PART 3 - INSTALLATION

3.1 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

PART 4 – CALIBRATION AND TRAINING

4.1 FIELD CALIBRATION AND TRAINING

- A. Prior to initiation of system start-up the Contractor must submit a certified statement from the Instrumentation Contractor that all field wiring is complete, has been terminated according to the latest set of approved shop drawings, and has been tested for improper grounds, short circuits and continuity.
- B. The Instrumentation Contractor shall systematically perform start-up and calibration of the control system and supply a written statement that the system has been tested and is operating correctly.

- C. After the testing in “B” is completed satisfactorily, the Instrument Contractor shall demonstrate to the Engineer and Owner that the system operates correctly. A proposed schedule for this demonstration shall be submitted a minimum of 14 days in advance.
- D. Upon demonstration of the correct system operation, the Engineer will accept the system. Following this acceptance the Instrument Contractor will conduct a 1 day training program for the Owner’s operating personnel on the field instruments. An additional 1 day of training is to be supplied for the operation of the PLC. A proposed schedule for this training shall be submitted a minimum of 14 days in advance.
- E. All calibration, testing, demonstrations, training, etc. shall be at no additional cost to the Owner.

PART 5 – SPARE PARTS

5.1 SPARE PARTS

- A. The Instrument Contractor shall furnish, upon completion of the project, one year’s supply of all consumable parts utilized within the instrumentation system, including pilot lights, fuses (minimum 5 of each type), etc.

END OF SECTION

SECTION 15000

MECHANICAL - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. All equipment furnished and installed under this contract shall conform to the general stipulations set forth in this section except as otherwise specified in other Sections.
2. Contractor shall coordinate all details of equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alternations in the work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

B. Related Work Described Elsewhere: Other sections directly referenced in this section include the following:

1. General Requirements: Division 1.
2. Concrete: Division 3.
3. Painting: Division 9.
4. Electrical: Division 16.

C. Contract Drawings and Specifications: The Contract Drawings and Specifications shall be considered as complementary, one to the other, so that materials and work indicated, called for, or implied by the one and not by the other shall be supplied and installed as though specifically called for by both. The Contract Drawings are to be considered diagrammatic, not necessarily showing in detail or to scale all of the equipment or minor items. In the event of discrepancies between the Contract Drawings and Specifications, or between either of these and any regulations or ordinances governing work of these specifications, the bidder shall notify the Engineer in ample time to permit revisions.

1.02 QUALITY ASSURANCE

- A. **Materials and Equipment:** Unless otherwise specified, all materials and equipment furnished for permanent installation in the work shall conform to applicable standards and specifications and shall be new, unused, and undamaged when installed or otherwise incorporated in the work. No such material or equipment shall be used by the contractor for any purpose other than that intended or specified, unless such use is specifically authorized in writing by the Owner. No material shall be delivered to the work site prior acceptance of drawings and data by the Engineer.
- B. **Equivalent Materials and Equipment:**
 - 1. Whenever a material or article is specified or described by using the name of a proprietary product or the name of a particular manufacturer or vendor, the specific item mentioned shall be understood as establishing the type, function, and quality desired. Other manufacturer's products will be accepted provided sufficient information is submitted to allow the Engineer to determine that the products proposed are equivalent to those named. Such items shall be submitted for review in accordance with Section 01340: Shop Drawings, Working Drawings, and Samples.
 - 2. Requests for review of equivalency will not be accepted from anyone except the Contractor and such requests will not be considered until after the contract has been awarded.
- C. **Governing Standards:** Equipment and appurtenances shall be designed in conformity with ANSI, ASME, ASTM, IEEE, NEMA, OSHA, AGMA, and other generally accepted applicable standards. They shall be of rugged construction and of sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation, and all conditions or operations. All bearings and moving parts shall be adequately protected against wear by bushings or other acceptable means. Provisions shall be made for adequate lubrication with readily accessible means.
- D. **Tolerances:** Machinery parts shall conform to the dimensions indicated on the drawings within allowable tolerances. Protruding members such as joints, corners, and gear covers shall be finished in appearance. All exposed welds shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.
- E. **Clearances:** Ample clearances shall be provided for inspection and adjustment. All equipment shall fit the allotted space and shall leave reasonable access room for servicing and repairs. Greater space and room required by substituted equipment shall be provided by the Contractor and at his expense.

F. Testing:

1. When the equipment is specified to be factory tested, the results of the tests shall be submitted to the Engineer and approval of the test results shall be obtained before shipment of the equipment.
2. When an item of equipment, including controls and instrumentation, has been completely erected, the contractor shall notify the Engineer, who will designate a time to make such tests as required, and operate the item to the satisfaction of the Engineer. All testing shall be done in the presence of the Engineer or Resident Project Representative. "Completely erected" shall mean that the installation is erected, all necessary adjustments have been made, all required utility connections have been made, required lubricants and hydraulic fluid have been added and the unit has been cleaned and painted.

G. Pressure Test:

1. After installation, all piping shall be pressure tested. Piping shall be tested in accordance with Section 15044: Pressure Testing of Piping.
2. All tests shall be made in the presence of and to the satisfaction of the Engineer and to the satisfaction of any local or state inspector having jurisdiction.
 - a. Provide not less than three days notice to the Engineer and the authority having jurisdiction when it is proposed to make the tests.
 - b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
 - c. The piping systems may be tested in sections as the work progresses by no joint or portion of the system shall be left untested.
3. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
4. All defects and leaks observed during the tests shall be corrected and made tight in an approved manner and the tests repeated until the system is proven tight.

5. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.
6. Provide test pumps, gauges, or other instruments and equipment required for the performance of all tests. Provide all temporary bracing, test plugs, additional restraint, and thrust blocking which may be required for test pressures above normal working pressures.
7. All tests shall be maintained for as long a time as required to detect all defects and leaks but not less than the duration specified for each type of pipe or piping system in this Division.

H. Failure of Test:

1. Defects: Any defects in the equipment, or deviations from the guarantees or requirements of the Specifications, shall be promptly corrected by the contractor by replacements 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 correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials which have entered into the manufacturer for such equipment, may reject that equipment and order the contractor to remove it from the premises at the contractor's expense.
2. Rejection of Equipment: In case the Owner rejects a particular item of equipment, then the contractor hereby agrees to repay to the Owner all sums of money paid to him to deliver to the contractor a bill of sale of all his rights, title, and interest in and to the rejected equipment provided, however that the equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected. The bill of sale shall not abrogate the Owner's right to recover damages for delays, losses or other conditions arising out of the basic Contract. The Owner hereby agrees to obtain the alternate equipment within a reasonable time and the contractor agrees that the Owner may use the original equipment furnished by him without rental or other charge until the other equipment is obtained.

- I. Responsibility During Tests: 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.

J. Acceptance of Materials:

1. Only new materials and equipment shall be incorporated in the work. All materials and equipment furnished by the contractor shall be subject to the inspection and acceptance of the Owner. No material shall be delivered to the work without prior submittal approval of the Engineer.
2. The contractor shall submit to the Engineer data relating to materials and equipment he proposes to furnish for the work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the Specifications.
3. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the contractor. If the Engineer requires, either prior to beginning or during the progress of the work, the contractor shall submit samples of materials for such special test as may be necessary to demonstrate that they conform to the Specifications. Such sample shall be furnished, stored, packed, and shipped as directed at the contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for tests.
4. The contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporation in the work.

K. Safety Requirements:

1. In addition to the components shown and specified, all machinery and equipment shall be safeguarded in accordance with the safety features required by the current codes and regulations of ANSI, OSHA, and local industrial codes.
2. The contractor shall provide for each V-belt drive or rotating shaft a protective guard, which shall be securely bolted to the floor or apparatus. The guard shall completely enclose drives and pulleys and be constructed to comply with all safety requirements.

1.03 SUBMITTALS (SEE SECTION 01340: SHOP DRAWINGS, WORKING DRAWINGS AND SAMPLES)

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Packaging: All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment,

handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.

- B. Protection: All machined surfaces and shafting shall be cleaned and protected from corrosion by the proper type and amount of coating necessary to assure protection during shipment and prior to installation. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage as specified in Sections 09900: Painting, and 09905: Paint and Equipment Identification System. All painted surfaces, which are damaged prior to acceptance of equipment, shall be repainted to the satisfaction of Engineer.
- C. Lubrication: Grease and lubricating oil shall be applied to all bearings and similar items as necessary to prevent damage during shipment and storage.
- D. Marking: Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.
- E. Fabricated sub-assemblies, if any, shall be shipped in convenient sections as permitted by carrier regulations and shall be properly match-marked for ease of field erection.
- F. Responsibility:
 - 1. The contractor shall be responsible for all material, equipment, and supplies sold and delivered to the site under this contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the contractor shall replace same without additional cost to the Owner.
 - 2. Should the contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.
- G. Delivery: The contractor shall arrange deliveries of products in accordance with construction schedules and coordinate to avoid conflict with work and conditions at the site.

1. The contractor shall deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, the contractor shall inspect shipments to assure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged.
3. Under no circumstances shall the contractor deliver equipment to the site more than one month prior to installation without written authorization from the Engineer. Operation and maintenance data shall be submitted to the Engineer for review prior to shipment of equipment as described in Section 01730: Operating and Maintenance Data.

H. Storage and Protection of Products:

1. The contractor shall furnish a covered, weather-protected storage structure providing a clean, dry noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Storage of equipment shall be in strict accordance with the "Instructions for Storage" of each equipment supplier and manufacturer including connection of space heaters, and placing of storage lubricants in equipment. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.
 - a. The contractor shall store products subject to damage by the elements in weathertight enclosures.
 - b. The contractor shall maintain temperature and humidity within the ranges required by manufacturer's instructions.
 - c. The contractor shall store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. The contractor shall cover products which are subject to deterioration with impervious sheet coverings and provide adequate ventilation to avoid condensation.
 - d. The contractor shall store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
2. All materials and equipment to be incorporated in the work shall be handled and stored by the contractor before, during, and after shipment in

a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind whatsoever to the material or equipment.

3. Cement, sand, and lime shall be stored under a roof and off the ground, and shall be kept completely dry at all times. All structural and miscellaneous steel and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water, staining, chipping, or cracking. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spalling to a minimum.
 4. All materials which, in the opinion of the Engineer, have become damaged and are unfit for the use intended or specified shall be promptly removed from the site of the work and the contractor shall receive no compensation for the damaged material or its removal.
 5. The contractor shall arrange storage in a manner to provide easy access for inspection. The contractor shall make periodic inspections of stored products to assure products are maintained under specified conditions, and free from damage or deterioration.
 6. Protection After Installation: The contractor shall provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. The contractor shall remove covering when no longer needed.
- I. Extended Storage Requirements For Equipment: Because of the long period allowed for construction, special attention shall be given to extended storage and handling of equipment onsite. As a minimum, the procedure specified herein shall be followed:
1. If equipment will be stored onsite for more than one month prior to incorporation into the work, the contractor shall submit a written request to the Engineer outlining any special provision to be made to protect and maintain the equipment while it is being stored. All such provisions shall be acceptable to the Owner. No equipment shall be stored onsite for more than one month without prior written authorization from the Engineer.
 2. All equipment having moving parts including gears, electric motors, and/or instruments shall be stored in a temperature and humidity controlled building accepted by the Engineer, until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil and grease unless otherwise instructed by the manufacturer.
4. Manufacturer's storage instructions shall be carefully studied by the contractor and reviewed by him with the Engineer. These instructions shall be carefully followed and a written record of this review kept by the contractor.
5. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the contractor shall start the equipment and operate, loaded when possible, once weekly for an adequate period of time to ensure 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. Mechanical equipment to be used in the work, if stored for longer than ninety days, shall have the bearings cleaned, flushed, and lubricated prior to testing and startup, at no extra cost to the Owner.
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 guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective, and it shall be removed and replaced at the contractor's expense.
8. A maintenance log shall be maintained by the contractor outlining the schedule of maintenance required for each piece of equipment as well as the date on which the maintenance was actually performed and the initials of the individual performing the work. Submit a copy of the maintenance log monthly with the progress pay application.

1.05 WARRANTY AND GUARANTEES

- A. The manufacturer's written warranty shall be submitted for all major pieces of equipment, as specified in Section 01740: Warranties and Bonds. The manufacturer's warranty period shall be concurrent with the contractor's correction period for one year after the time of completion and acceptance.

1.06 SPARE PARTS

- A. Spare parts for certain equipment provided under Divisions 11 - Equipment; 13 - Special Construction; 15 - Mechanical; and 16 - Electrical have been specified in the pertinent sections of the specifications. The contractor shall collect and store all spare parts in an area to be designated by the Engineer. In addition, the contractor shall furnish to the Engineer an inventory listing of all spare parts, the equipment they are associated with, and the name and address of the supplier.

1.07 MAINTENANCE MATERIALS

- A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.
- B. The contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

PART 2 - PRODUCTS

2.01 FABRICATION AND MANUFACTURE

- A. Workmanship and Materials:
 - 1. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage or other failure. Materials shall be suitable for service conditions.
 - 2. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
 - 3. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least ¼-inch thick.
- B. Lubrication:

1. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.
 2. Lubricants of the type recommended by the equipment manufacturer shall be furnished by the contractor in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.
 3. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.
- C. Drive Units: Unless otherwise specified, drive units furnished with equipment shall meet the following requirements. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24-hour continuous service.
1. Gear Reducers:
 - a. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated anti-friction, rolling element bearings throughout.
 - b. Helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class 11. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall bear an AGMA nameplate.
 - c. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100 degrees Fahrenheit (°F) above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.
 - d. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly

dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.

- e. Gear reducers which require the removal of parts or periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
- f. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer, and that the unit provided is fully compatible with the conditions of installation and service.

D. Safety Guards: All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage or heavier galvanized aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal or 316 stainless steel mesh. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

E. Equipment Foundation Supports:

- 1. All foundations, platforms and hangers required for the proper installation of equipment shall be furnished and installed by the Contractor.
- 2. Unless otherwise indicated or specified, all equipment shall be installed on reinforced concrete bases at least 6 inches high and shall conform to Section 03300: Cast-In-Place Concrete. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03600: Grout. All open equipment bases shall be filled with non-shrinking grout sloped to drain to the perimeter of the base.
- 3. The contractor shall furnish, install and protect all necessary guides, bearing plates, anchor and attachment bolts, and all other appurtenances

required for the installation of equipment. These shall be of ample size and strength for the purpose intended.

4. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolts shall comply with, unless otherwise specified, shall have a minimum diameter of ¾-inch. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1 1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.
5. Structural steel supports and miscellaneous steel required for supporting and/or hanging equipment and piping furnished under this Division shall be provided and installed by contractor.
6. All foundations, anchor pads, piers, thrust blocks, inertia blocks and structural steel supports shall be built to template and reinforced as required for loads imposed on them.
7. The contractor shall assume all responsibility for sizes, locations and design of all foundations, anchor pads, pier, thrust blocks, inertia blocks, curbs and structural steel supports.

F. Shop Painting:

1. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil-resistant enamel suitable for coating in the field with an alkyd enamel. Coatings shall be suitable for the environment where the equipment is installed.
2. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer. Unless otherwise specified, the shop primer for steel and iron surfaces shall be Cook "391-N-167 Barrier Coat," Koppers "No. 10 Inhibitive Primer," or equal.

3. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344," Rust-Oleum "R-9," or equal.
- G. Nameplates: Contractor shall provide equipment identification nameplates for each item of equipment. Nameplates shall be 1/8-inch Type 304 stainless steel and shall be permanently fastened. Plates shall be fastened using round head metallic drive screws, or where metallic drive screws are impractical, with stainless steel pop rivets. Metallic drive screws shall be brass or stainless steel, Type V and No. 8 by 3/8-inch long. Names and/or equipment designations shall be engraved on the plates and the engraving painted with a primer and black paint system compatible with stainless steel. Contractor shall submit a list of proposed names and designations for review prior to fabrication of nameplates. At a minimum, each nameplate shall include equipment manufacturers name, year of manufacture, serial number and principal rating data.
- H. Noise Attenuation and Control:
1. Unless otherwise specified, the maximum permissible noise level for a complete installed piece of equipment located within or outside a structure shall not exceed 85 dB at 3 feet. A complete piece of equipment includes the driver and driven equipment, plus any intermediate couplings, gears, and auxiliaries. All equipment provided herein that is specified to be factory and field tested shall be tested as specified herein for noise generation at the equipment manufacturer's expense.
 2. Maximum permissible noise (sound pressure) levels shall be in decibels as read on the "A" weighting scale of a standard sound level meter (dB); all measurements shall be made in relation to a reference pressure of 0.0002 microbar. Measurements of emitted noise levels shall be made on a sound level meter meeting at least the Type 2 requirements set forth in ANSI S1.4, Specification for Sound Level Meters. The sound level meter shall be set on the "A" scale and to slow response. Unless otherwise specified for a particular piece of equipment, the point of measurement of sound level shall be made at the specified distance from any major surface along the entire perimeter and at mid-height of the piece of equipment, or at the specified distance from an outer major surface encompassing the sound source including inlets or outlets.
- I. Fire Hazard Rating:
1. All piping, duct work, and equipment insulation, fastener, and jacketing materials shall have a fire hazard rating not to exceed 25 for flame spread, 50 for fuel contributed, and 50 for smoke developed. Rating shall be determined by ASTM Designation E84, "Surface Burning Characteristics

of Building Materials." Corresponding ratings determined by Underwriters' Laboratories, Inc., UL-723, "Test Method for Fire Hazard Classification of Building Materials," will also be acceptable.

2. Flameproofing treatments will not be acceptable.

2.02 ACCESSORIES

- A. Special Tools and Accessories: Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.
- B. Fasteners: All nuts, bolts, anchors and other fastening devices shall be a minimum of 304 stainless steel unless otherwise specified.

PART 3 - EXECUTION

3.01 INSTALLATION AND OPERATION

- A. Installation: Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of contractor or his subcontractors are not qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.
 1. The contractor shall have on site sufficient proper construction equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory-assembled when practical.
 2. Equipment shall be erected in a neat and workmanlike manner on the foundations and supports at the locations and elevations shown on the Drawings, unless otherwise directed by the Engineer during installation.
 3. All equipment shall be installed in such a manner as to provide access for routine maintenance including lubrication.
 4. For equipment such as pumping units, which require field alignment and connections, the contractor shall provide the services of the equipment manufacturer's qualified mechanic, millwright, machinist, or authorized representative, to align the pump and motor prior to making piping connections or anchoring the pump base.

5. Equipment of a portable nature, which requires no installation, shall be delivered to a location designated by the Owner.
- B. Tolerances: Precision gauges and levels shall be used in setting all equipment. All piping and equipment shall be perfectly aligned, horizontally and vertically. Tolerances for piping and equipment installation shall be ½-inch to 30-ft horizontal and vertically. All valves and operators shall be installed in the position shown on the Contract Drawings or as directed by the Engineer, if not shown.
- C. Alignment and Level: The equipment shall be brought to proper level by shims 1/- inch maximum. After the machine has been leveled and aligned, the nuts on the anchor bolts shall be tightened to bind the machine firmly into place against the wedges or shims. Grouting shall be as specified in Section 03600: Grout.
- D. Grouting: The grout shall be tamped into position with a board, steel bar, or other tool. Tamping should not be so hard as to raise or otherwise displace the plate.
- E. Contact of Dissimilar Metals: Where the contact of dissimilar metal may cause electrolysis and where aluminum will contact concrete, mortar, or plaster, the contact surface of the metals shall be separated using not less than one coat of zinc chromate primer and one heavy coat of aluminum pigmented asphalt paint on each surface.
- F. Cutting and Patching: All cutting and patching necessary for the work shall be performed by the contractor.
- G. Operation: All equipment installed under this Contract, including that furnished by Owner or others under separate contract, shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.

3.02 OBSERVATION OF PERFORMANCE TESTS

- A. Where the specifications require observation of performance tests by the Engineer or Resident Project Representative, such tests shall comply with the quality assurance paragraph in this section.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Services Furnished Under This Contract:
 1. An experienced, competent, and authorized representative of the manufacturer of each item of equipment shall visit the site of the work and

inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the jobsite as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

2. Each manufacturer's representative shall furnish to Owner and Engineer a letter of certification stating that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.
3. All costs for field services shall be included in the contract amount.

END OF SECTION

SECTION 15044

PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: This section specifies the leakage testing requirements for plant piping.
- B. Test Pressures: Test pressures for the various services and types of piping are shown in Table 15044, at the end of this Section.
- C. Testing Records:
 - 1. Provide a record of each piping installation during the testing. These records shall include:
 - a. Date of test.
 - b. Identification of pipeline tested or retested.
 - c. Identification of pipeline material.
 - d. Identification of pipe specification.
 - e. Test fluid.
 - f. Test pressure.
 - g. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
 - h. Certification by Contractor that the leakage rate measured conformed to the Specifications.
 - i. Signature of Owner's representative witnessing pipe test.
 - 2. Submit five (5) copies of the test records to the Engineer's representative upon completion of the testing.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Testing fluid shall be water for all hydrostatic tests.

2.02 MATERIALS AND EQUIPMENT

- A. Provide pressure gauges, pipes, bulkheads, pumps, and meters to perform the hydrostatic and pneumatic testing.

PART 3 - EXECUTION

3.01 TESTING PREPARATION

- A. Pipes shall be in place and anchored before commencing pressure testing.
- B. Conduct hydrostatic and pneumatic tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.
- C. Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes.
- D. Test new pipelines which are to be connected to existing pipelines by isolating the new line from the existing line by means of pipe caps, special flanges, or blind flanges. After the new line has been successfully tested, remove caps or flanges and connect to the existing piping.
- E. Conduct hydrostatic tests on buried pipe after the trench has been completely backfilled. The pipe may be partially backfilled and the joints left exposed for inspection for an initial leakage test. Perform the final test, however, after completely backfilling and compacting the trench.
- F. Pressure Test:
 - 1. All tests shall be made in the presence of and to the satisfaction of the Owner or Engineer and to the satisfaction of any local or state inspector having jurisdiction.
 - a. Provide not less than three (3) days notice to the Owner, Engineer, and the authority having jurisdiction when it is proposed to make the tests.

- b. Any piping or equipment that has been left unprotected and subject to mechanical or other injury in the opinion of the Engineer shall be retested in part or in whole as directed by the Engineer.
 - c. The piping systems may be tested in sections as the work progresses, but no joint or portion of the system shall be left untested.
- 2. All elements within the system that may be damaged by the testing operation shall be removed or otherwise protected during the operation.
 - 3. Repair all damage done to existing or adjacent work or materials due to or on account of the tests.

3.02 INSPECTION AND TESTING

- A. Hydrostatic Testing of Aboveground or Exposed Piping: Open vents at high points of the piping system to purge air while the pipe is being filled. Subject the piping system to the test pressure indicated. Maintain the test pressure for a minimum of four (4) hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show no leakage or weeping. Correct leaks and retest until no leakage is obtained.
- B. Hydrostatic Testing of Buried Piping:
 - 1. Where any section of the piping contains concrete thrust blocks or encasement, do not make the pressure test until at least 10 days after the concrete has been poured. When testing mortar-lined piping, fill the pipe to be tested with water and allow it to soak for at least 48-hours to absorb water before conducting the pressure test.
 - 2. Apply and maintain the test pressure by means of a hydraulic force pump. Maintain the test pressure for a minimum duration of four (4) hours. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure during the four hours. This amount of water is the loss due to leakage in the piping system. The allowable leakage rate is defined by the formula.

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

in which:

L = allowable leakage (gallons/hour) during the test period.
 S = length of pipe, in feet

D = diameter of the pipe (inches)
P = specified test pressure (psig)

3. Repair and retest any pipes showing leakage rates greater than that allowed.

TABLE 15044
PIPING PRESSURE TEST SCHEDULE

Service	Mark	Test Pressure (psig)
Gravity Drain	DR	25 (Piping above Grade) 25 (Low Pressure Air Piping Below Grade)
Force Main	FM	100
Mixed Liquor	ML	25
Non-Potable Water	NPW	150
Potable Water	PW	150
Return Activated Sludge	RAS	100
Raw Wastewater	RWW	150
Scum	SC	100
Secondary Effluent	SEFF	25
Filtered Effluent	FE	25
Waste Activated Sludge	WAS	50
Reuse Water	RW	150
Raw Wastewater/Return Activated Sludge	RWW/RAS	50
Alum Solution	AS	100
Chlorine Solution	CS	150
Polymer Solution	PS	100
Substandard Effluent	SSE	150

NOTES:

1. Piping not listed and sections of piping in gross discrepancy with listed pressure, with the approval of the Engineer, shall be tested at a minimum of 1.5 times working pressure.
2. Lime slurry flexible tubing shall be visually tested for leaks at the test pressure recommended by the tubing manufacturer.

END OF SECTION

SECTION 15050

PROCESS AND UTILITY PIPING, FITTINGS, VALVES, AND ACCESSORIES

PART 1-GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The Work included in this Section consists of furnishing all labor, equipment, and materials and in performing all operations necessary for the construction or installation of all process and utility piping, valves, and appurtenances complete and ready for operation as shown on the Drawings and specified herein.
- B. Related Work Described Elsewhere:
 - 1. Section 09900: Painting
 - 2. Section 09905: Piping, Valve, and Equipment Identification System
 - 3. Section 15044: Pressure Testing of Piping

1.02 QUALITY ASSURANCE

- A. Construction Requirements:
 - 1. All the lines shall be installed with at least 36-inches of cover, unless otherwise shown or indicated on the Drawings.
 - 2. For underground utilities, changes in horizontal alignment of less than 11-1/4 degrees may be achieved through the use of allowable pipe deflection in lieu of fittings shown on the Drawings at the contractor's option, but subject to approval of the Engineer as to layout. Said deflection shall not exceed 80 percent of the maximum allowable deflection as stated in the pipe manufacturer's installation instructions.
 - 3. All piping installed underneath structures or concrete slabs shall be ductile iron Pressure Class 250 for 14-inch pipe and larger and Pressure Class 350 for 12-inch pipe and smaller.
- B. Pipe Inspection: The contractor shall obtain from the pipe manufacturers a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these Specifications. All pipe and fittings shall be subject to visual inspection at time of delivery by rail or truck and also just before they are lowered into the trench to be laid. Joints or fittings that do not conform to these Specifications will be rejected and must be removed immediately by the Contractor.

The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

1.03 SUBMITTALS

A. Shop Drawings:

1. In general, the following Shop Drawings shall be submitted to the Engineer for approval prior to construction:
 - a. Mill test certificates or certified test reports on pipe and fittings.
 - b. Details of restrained and flexible joints.
 - c. Safety shower.
 - d. Valve boxes.
 - e. All valves, including gate, plug, ball, check, air release, solenoid, and telescoping valves.
 - f. Couplings.
 - g. Service saddles.
 - h. Pressure gauges.
 - i. Flexible expansion joints, tie rods, and flanged coupling adapters.
 - j. Joint lubricant.
 - k. Detailed piping layout drawings and pipe laying schedule (see below).
 1. Temporary plug and anchorage system for hydrostatic pressure test.
 - m. Sediment strainers.
 - n. Valve and meter vaults.

2. Tabulated layout schedule for each pipe system including:
 - a. Pipe invert station and elevation at each change of grade and alignment.
 - b. The limits of each reach of pipe thickness class and of restrained joints.
 - c. The limits of each reach of concrete encasement.
 - d. Locations of valves and other mechanical equipment.
 - e. Methods and locations of supports.
 - f. Details of special elbows and fittings.
3. A separate Shop Drawing submittal will be required for each major item listed above and for each different type of an item within a major item. For example, separate submittals will be required for butterfly, plug, ball, solenoid, check, and automatic air release valves. All submittals shall be in accordance with the General and Special Conditions and Section 01340: Shop Drawings, Working Drawings, and Samples.

B. Acceptance of Material:

1. The contractor shall furnish an Affidavit of Compliance certified by the pipe manufacturer that the pipe, fittings, and specials furnished under this Contract comply with all applicable provisions of current AWWA and ASTM standards and these Specifications. No pipe or fittings will be accepted for use in the work on this project until the Affidavit has been submitted and approved by the Engineer.
2. The Owner reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

C. Operation and Maintenance Manuals: Submit operation and maintenance manuals for applicable components requiring periodic maintenance and/or explanation of operation, at the discretion of the Engineer. Manuals shall be prepared in accordance with Section 01730: Operating and Maintenance Data. Information shall include:

1. Detailed assembly drawings, clear and concise instructions for operating, adjusting, overhauling, troubleshooting and, other maintenance. Include Shop Drawings previously submitted and approved with all corrections made.

2. A complete lubrication schedule including lubricant types, grades, and recommended frequency of lubrication.
3. A list of parts for all products with catalog numbers and all data necessary for ordering replacement parts. Such instructions and parts lists shall be prepared for the specific product furnished and shall not refer to other types or models.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Pipe, fittings, valves, and accessories shall be handled in such manner as to ensure a sound undamaged condition during shipping, delivering, and installing.
- B. Particular care shall be taken not to injure the pipe coating and linings.
- C. Insides of valves and piping shall be kept free of dirt and debris.

1.05 JOB CONDITIONS

- A. Water in Excavation: Water shall not be allowed in the trenches while underground pipes are being laid and/or tested. The contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Engineer. The contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately plugged during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Engineer so that the entire system will be left clean and unobstructed.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI, A21.51 and AWWA C151, latest revision. The minimum thickness class for underground pipe shall be Pressure Class 350 for 12-inch pipe and smaller and Pressure Class 250 for 14-inch pipe and larger. Flanged pipe shall have a minimum thickness class of Class 53.
- B. Pipe shall have a minimum rated water working pressure of 250 psi and shall be furnished in laying lengths of 20-feet or less, unless specifically shown otherwise

on the Drawings. All piping and fittings shall be new and unused, no refurbished piping or fittings will be accepted.

C. Coating and Lining: (Use as specified herein unless otherwise indicated on the Drawings)

1. Epoxy Interior Lining: Ductile iron pipe, fittings, and specials shall be lined with Protecto 401 Ceramic Epoxy, a high build multi-component amine cured Novalac epoxy lining, containing at least 20 percent by volume of ceramic quartz pigment, manufactured by Indurall Coatings, Inc., Birmingham, Alabama, or approved equal. The interiors of the ductile iron pipe, fittings, and specials shall receive 40 mils dry film thickness (DFT) of the ceramic epoxy protective lining. Storage, surface preparation, application, and safety precautions shall strictly follow manufacturer's instructions.
2. Cement-Mortar Interior Lining: Ductile iron pipe, fittings, and specials shall be cement lined in accordance with ANSI/AWWA C104, current revision, "Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water." The cement lining shall have standard thickness and, after curing, the lining shall have a seal coat of bituminous material in accordance with AWWA C104, current revision.
3. Exterior Coatings for Buried Pipe: Ductile iron pipe, fittings, and specials to be installed underground shall be coated on the exterior at the factory with one coat, 1 mil DFT, of asphaltic coating per AWWA C151, C110 and C153. All clamps, bolts, nuts, studs, and other uncoated parts of joints for underground installation shall be coated with coal tar epoxy prior to backfilling. Coal tar epoxy shall be equal to Kop-Coat Bitumastic No. 300-M.
4. Exterior Coating for Exposed Pipe: Ductile iron pipe, fittings, and specials to be installed aboveground shall be furnished with a shop applied primer on the exterior. The shop primer shall be as specified in Section 09900: Painting. Exposed piping shall be painted in accordance with Sections 09900 and 09905.
5. Pipe Labeling: Pipe manufacturer shall label in large legible lettering on the exterior of the pipe the type of pipe interior lining.

D. Fittings: Fittings for ductile iron pipe shall be either mechanical joint, restrained joint, flanged joint, or grooved-end coupling as indicated on the Drawings and shall have a minimum working pressure of 250 psi. Fittings shall be ductile iron and shall conform to ANSI/AWWA C110, ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions for flanged and mechanical joint pipe, and

grooved-end fittings shall conform to AWWA C110 and ANSI B16.1 with grooved ends conforming to AWWA C606, radius cut rigid joints. Fittings shall be coated and lined as indicated on the Drawings, in the manner specified above for ductile iron pipe. The rubber gaskets for flanged, mechanical, and push-on joints shall be as described below.

- E. Push-On Joints: Pipe using push-on joints shall be in strict accordance with AWWA C111 and ANSI A21.11, latest revision and shall be as manufactured by American Cast Iron Pipe Company (Fastite Joint), United States Pipe Company (Tyton Joint), or Clow Corporation (Super Bell Tite Joint). Jointing materials shall be provided by the pipe manufacturer and installation shall be in strict accordance with the manufacturer's recommended practice.
- F. Mechanical Joints: Jointing materials for mechanical joints shall be provided by the pipe and fitting manufacturer. Materials assembly and bolting shall be in strict accordance with ANSI/AWWA C111 and ANSI/AWWA C153, latest revisions. Tee head bolts and nuts for mechanical joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel as manufactured by NSS Industries, Plymouth, Michigan, or an equal approved by the Engineer.
- G. Flanged Joints: Flanges shall be Class 125 per ANSI B16.1 with any special drilling and tapping as required to insure correct alignment and bolting.
 - 1. Gaskets: Fullface, 1/8-inch thick, cloth-inserted rubber: Johns-Manville No. 109, John Crane Co., Style 777, or equal. Gaskets shall be suitable for a water pressure of 350 psi at a temperature of 150°F.
 - 2. Bolts and Nuts for Flanges:
 - a. Bolts and nuts for flanges located indoors, in enclosed vaults, in structures, and outdoors aboveground shall be carbon steel, ASTM A307, Grade B.
 - b. Bolts and nuts for buried and submerged flanges and flanges located below grade in open vaults and structures shall be Type 316 stainless steel conforming to ASTM A193, Grade B8M for bolts and ASTM A194, Grade 8M for nuts. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to percent galling during installation.
 - 3. Flanges shall be long-hub type screwed tightly on pipe by machine at the foundry prior to facing and drilling. Flange machine surfaces shall be coated with rust inhibitor immediately after facing and drilling. Field assembled screwed on flanges are prohibited.

H. Grooved-End Couplings:

- a. Grooved-end couplings shall be malleable iron, ASTM A47 (Grade 32510), or ductile iron, ASTM A536 (Grade 65-45-12). Bolts shall be ASTM A183, 110,000 psi tensile strength. Gaskets shall be halogenated butyl rubber or EPDM for water service and Buna-N for sewage service, conforming to ASTM-D-2000.
- b. Couplings shall be Victaulic Style 31 or equal.

I. Restrained Joints and Fittings: Pipe joints and fittings shall be restrained in accordance with the Drawings and the requirements of this Specification. It is intended that, at a minimum, all fittings shall be restrained. In cases where the calculated required length of restrained pipe is not evenly divisible by nominal laying lengths of pipe, the total required length of restrained pipe shall be rounded up to the next closest nominal length that is evenly divisible by the standard laying length.

1. Manufactured Restrained Joints: Manufactured restrained joints shall be Flex-Ring, Lok-Ring, or Lok-Fast manufactured by the American Cast Iron Pipe Company, Lok-Tyte or Tr-Flex Type manufactured by the United States Pipe Company, or an equal approved by the Engineer. Joints shall be manufacturer's standard specifically modified push-on type joints with joint restraint provided by ductile iron retainer rings joined together by corrosion-resistant, high strength steel tee head bolts and nuts or with joint restraint provided by a welded-on retainer ring and a split flexible ring assembled behind the retainer ring.
2. Restrained joint pipe and fittings shall be ductile iron only and shall comply with applicable portions of this Specification. Manufactured restrained joints shall be capable of deflection during assembly. Deflection shall not exceed 80 percent of the manufacturer's recommendations.
3. Tee head bolts and nuts for restrained joints shall be manufactured of CORTEN, high strength, low alloy, corrosion resistant steel as manufactured by NSS Industries, Plymouth, Michigan, or an equal approved by the Engineer.

J. Alternate Restrained Joints: When prior approval is obtained from the Engineer, ductile iron pipe and fittings with mechanical joints may be restrained using a follower gland which includes a restraining mechanism. When actuated during installation, the restraining device shall impart multiple wedging action against the pipe wall, which increases resistance as internal pressure in the pipeline increases.

1. The joint shall maintain flexibility after installation. Glands shall be manufactured of ductile iron conforming to ASTM A536 and restraining devices shall be of heat-treated ductile iron with a minimum hardness of 370 BHN. The gland shall have standard dimension and bolting patterns for mechanical joints conforming to ANSI/AWWA C111 and C153, latest revisions.
2. Tee head bolts and nuts shall be manufactured of corrosion-resistant, high strength, low alloy CORTEN steel in accordance with ASTM A242.
3. The restraining wedges shall have twist-off nuts to insure proper torquing. The mechanical joint restraint device shall have a minimum working pressure rating of 250 psi with a minimum safety factor of 2 to 1 and shall be MEGALUG[®] as manufactured by EBBA Iron, Inc. No other retainer gland type device will be acceptable. After installation prior to backfilling, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Small Gravity Drainage Piping: PVC pipe smaller than 4-inches nominal diameter used for gravity drainage piping shall be Schedule 40 pipe in accordance with ASTM D1785. Schedule 40 PVC pipe shall have solvent welded joints as specified for PVC pressure pipe.
- B. Large Gravity Drainage Piping: Unless otherwise noted, large gravity drainage piping for nominal diameters 4-inches and larger in size shall conform to the requirements of AWWA C900 DR25 up to 12-inches and AWWA C905 DR25 larger than 12-inches with gasketed integral bell ends. Pipe shall be designed for a maximum working pressure at not less than 100 psi and with not less than a 4 to 1 sustained hydrostatic pressure safety factor. Fitting shall be ductile iron fittings with restrained mechanical joint and as specified herein. Pipe shall be made of ductile iron pipe O.D.'s instead of IPS.
- C. Small PVC Pressure Piping: Unless otherwise specified, PVC pressure pipe smaller than 4 inches nominal diameter shall be Schedule 80 PVC in accordance with ASTM D1785. Schedule 80 pipe shall have either solvent welded or threaded joints. PVC pressure pipe shall bear the approved seal of the National Sanitation Foundation (NSF). PVC pipe that is exposed to sunlight shall be manufactured with additives to provide resistance to ultraviolet deterioration.
 1. Fittings: Socket type, solvent welded fittings for Schedule 80 PVC pipe shall be in conformance with ASTM D2467. Threaded type fittings for Schedule 80 PVC pipe shall be in conformance with ASTM D2464. All solvent welded or threaded joints shall be watertight.

2. Flanges: Flanges for Schedule 80 PVC pipe shall be rated for a 150 psi working pressure with ANSI B 16.1 dimensions and bolting pattern. Flanges shall be connected to PVC piping with either solvent welded or threaded joints in accordance with ASTM D2467 or ASTM 2464, respectively. Gaskets shall be neoprene, full faced type with a minimum thickness of 1/8-inch. Nuts and bolts shall be hexagonal with machine threads, manufactured of Type 316 stainless steel in accordance with ASTM A320, Class 2. Type 316 stainless steel flat washers w/lock washers shall be used against PVC flanges. The nuts shall have a hardness that is lower than that of the bolts and washers by a difference of 50 Brinnell hardness to prevent galling during installation.
 3. Solvent Cement: PVC solvent cement shall be in compliance with ASTM D2564 and in accordance with the pipe manufacturer's recommendations.
 4. Thread Lubricant: Lubricant for Schedule 80 threaded joints shall be Teflon tape only.
- D. Large PVC Pressure Piping: Unless otherwise noted, PVC pressure pipe for nominal diameters 4-inches and larger in size shall conform to the requirements of AWWA C900 DR18 up to 12-inches, and AWWA C905 DR18 larger than 12-inches with gasketed integral bell ends. Pipe shall be designed for maximum working pressure of not less than 150 psi and with not less than a 4 to 1 sustained hydrostatic pressure safety factor. Fittings shall be ductile iron fittings with restrained mechanical joint ends as specified herein. Pipe shall be made to ductile iron pipe O.D.'s instead of IPS.
1. Bell and Spigot:

Pipe joints shall be made with integral bell and spigot pipe ends. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with factory glued rubber ring gasket which conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "Elastomeric Seals (Gaskets) for Joining Plastic Pipe." PVC joints shall be "Ring-Tite" as manufactured by J-M Manufacturing Company, Inc. or an equal approved by the Engineer.
 2. Restrained Joints:

In accordance with the Drawings, to prevent pipe joints and fittings from separating under pressure, pipe joints and fittings shall be restrained as follows:

 - a. PVC pipe bell and spigot joints shall be restrained with the EBBA Iron MEGALUG[®] Series 1500 Restrainer or an equal approved by

the Engineer. The restraining device and tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 6542-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.

- b. Mechanical joint fittings used with PVC pipe shall be restrained with the EBBA Iron MEGALUG[®] Series 2000 PV Restrainer or an equal approved by the Engineer. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy CORTEN steel meeting the requirements of ASTM A242.

- E. Clear PVC Reinforced Tubing: Clear PVC tubing, for lime slurry applications shown on the Drawings, shall be nylon reinforced, PVC clear tubing. The inside diameter shall be 2-inches with an outside diameter of 2-1/2 inches. Tubing shall be a minimum of 105 pounds per 100 feet and able to withstand a working pressure of 75 psi. Tubing shall be Amaclear "R" as manufactured by Amazon Hose Rubber Company, or approved equal.

2.03 STEEL PIPE AND FITTINGS

- A. Stainless Steel: Pickled and passivated, ASTM A778, Type 304L, "as welded" grade, ASTM A 312, Schedule 405, seamless.
- B. Fittings:
 - 1. Stainless Steel: Screwed, 150 pound, forged AWWA A182, Grade F 304 or bar stock to ASTM A276, Type 304.

2.04 WALL SLEEVES, SEALS, AND PIPES AND NON-STANDARD CASTINGS

- A. Wall Sleeves:
 - 1. Wall sleeves shall be of cast iron, ductile iron, or carbon steel hot-dip galvanized after fabrication (see below for plastic alternate) and shall have a seep ring located in the center of the wall. Sleeves shall be provided with seals and shall be oversized as required for the installation of seals. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2-inches above the finished floor.
 - 2. When noted on the Drawings, smaller pipe sleeves in CMU specified as PVC, shall be SCH 80 PVC. Sleeves shall be grouted in place and shall be oversized as required for the installation of process pipe and sealant

materials. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2-inches above the finished floor.

3. For poured or grouted in place sleeves, lightweight, high-impact thermoplastic sleeves may be substituted. Plastic sleeves shall have integral waterstop and anchoring ribs. Plastic sleeves shall be a product of the sleeve seal manufacturer and shall be Century Line Sleeves as manufactured by Thunderline Corporation, or equal.
 4. Wall sleeves shall be installed for all piping passing through building walls and floors, except where noted on the Drawings. Sleeves shall be of sufficient size to pass the pipe without binding. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2-inches above the finished floor. Escutcheons shall be provided at walls and floor to completely conceal the sleeves smaller than 3-inches. Escutcheons shall be cast iron, nickel-plated split-type.
- B. Wall Sleeve Seals: Wall sleeve seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. The synthetic rubber shall be suitable for exposure to water, wastewater, and groundwater. Bolts, nuts, and hardware shall be 316 stainless steel. The seals shall be Link Seal as manufactured by Thunderline Corporation or equal, and the wall sleeve and seal shall be sized as recommended by the seal manufacturer.
- C. Wall Pipes: Wall pipes shall be of the size and types indicated on the Drawings. All wall pipes shall be of ductile iron and shall have a central fin not less than ½-inch thick and the same diameter as the bolting flange cast midway of the length to form a waterstop. Each wall pipe shall be of the same grade, thickness and interior coating as the piping to which it is joined. Those portions of the wall pipes that are buried shall have a coal tar epoxy outside coating.
- D. Non-Standard Fittings and Castings: Fittings having non-standard dimensions and cast especially for this project shall be of an approved design. Fittings shall be manufactured to meet the requirements of the same Specifications and shall have the same diameter and thickness as standard fittings but laying lengths and types of ends shall be determined by positions in the pipelines and by the particular piping to which it is connected. Flange facing and drilling shall conform to the 125 pound American National Standard. Where required, flanges shall be drilled and tapped for studs. Other dimensions shall be substantially equal to corresponding parts of standard bell and spigot fittings.

2.05 PIPE COUPLINGS

- A. Couplings: Pipe couplings used to joint two pieces of plain end pipe shall be sized to suit the outside diameter of the pipe ends to be jointed. Transition couplings shall be used to join pipes of different outside diameters. Pipe couplings shall be bolted type with steel middle ring and end followers.
- B. Coating: All carbon steel parts of the coupling shall be coated on the interior and exterior with a fusion bonded thermosetting epoxy coating with a 12-mil nominal coating thickness. The coating shall be equal to AL-CLAD as manufactured by Dresser Industries, Inc.
- C. Gaskets: Gaskets for the coupling shall be wedge type manufactured of Buna-N resilient rubber.
- D. Bolts: Bolts shall be manufactured of high strength Type 316 stainless steel with Type 316 stainless steel hexagonal nuts. Bolts and nuts shall conform dimensionally to ANSI/AWWA C111, latest revision.
- E. Manufacturer: Couplings shall be Style 38 as manufactured by Dresser Industries, Inc., or an equal approved by the Engineer.

2.06 PVC VALVES

- A. Diaphragm Valves: All PVC diaphragm valves 1/2-inch through 4-inch in size shall be of solid thermoplastic construction for both body and bonnet, manufactured of Type 1, Grade 1 PVC. Diaphragm valves shall be manufactured with 150 psi flanged ends in accordance with ANSI B16.1 dimensions and bolting patterns. The valve shall provide a large weir surface to allow a greater flow with less movement of the diaphragm, to assure long diaphragm life. Diaphragm shall be manufactured of Hypalon and shall provide a bubble tight closure for a maximum water working pressure of 150 psi at 100°F. Valve bonnet shall be metal reinforced and bolted such that the diaphragm may be replaced without removing the valve body from the pipeline. Diaphragm valve shall be furnished with a handwheel operator and a position indicator with an adjustable travel stop to prevent overtightening. PVC diaphragm valves shall be manufactured by Asahi/America, or an equal approved by the Engineer.
- B. Ball Valves: All PVC ball valves 1/2-inch through 4-inch in size shall be of one piece capsule type manufactured of Type 1, Grade 1 PVC. Ball check valves shall be true union design with two-way blocking capability and shall have solvent welded socket or NPT threaded ends. Ball check valves shall have Teflon seats with Viton backing cushions and Viton O-ring seals, and shall be designed for a 150 psi water working pressure at 120°F. Valves shall be supplied with ABS lever operating handles. PVC ball valves shall be manufactured by Asahi/America, or an equal approved by the Engineer.

Electric Actuator for PVC Ball Valves: Where indicated on the Drawings, PVC ball valves shall be provided with an electric actuator. The actuator shall be matched to the valve and shall have sufficient operating torque to operate the valve for its maximum expected breakaway torque. The actuator shall be capable of full 90 degree actuation within 10 seconds. The actuator shall be UL listed and suitable for 120 volt AC, 60 hz, one-phase electric power, and shall be provided with a corrosion-resistant, NEMA 4 enclosure. The valve actuator shall be provided with a manual operator override, which is disengageable such that the valve cannot be operated electrically while the manual override is engaged. Actuator shall be furnished with a high torque, reversible, brushless, capacitor run motor with built-in motor overload protection, and gears and shafts shall be heat treated, high alloy steel. The unit shall be permanently lubricated and travel limit switches shall be independently adjustable. The actuator shall be provided with an integral electrical terminal strip, position indicator, overtorque protection, and travel limit switches for position light operation. The valve actuator enclosure shall be provided with a combination heater and thermostat to maintain the case interior above 40°F. Two additional limit switches shall be provided to energize and de-energize a pump interlocked with the valve. The electric actuator shall be a Model 92 Electric Valve Actuator as manufactured by Asahi/America, or an equal approved by the Engineer.

- C. Ball Check Valves: All PVC ball check valves 1/2-inch through 2-inch in size shall be of a solid thermoplastic construction manufactured of Type 1, Grade 1 PVC. Ball check valves shall be true union design with solvent welded socket or NPT threaded ends. Ball check valves shall be furnished with a solid thermoplastic ball and stainless steel spring to assist ball in seating faster. Ball seat shall be Teflon coated Viton. The same seal shall function as both the ball seat and the union seal. PVC ball check valves shall be designed for a 150 psi water working pressure at 120°F. Valves shall be manufactured by Asahi/America, or an equal approved by the Engineer.

2.07 STAINLESS STEEL BALL VALVES

- A. Stainless steel ball valves shall be standard port type for the sizes indicated on the Drawings or specified herein. Ball valves shall be designed for a working pressure of 200 psi with positive shut off when in the closed position. Valve body and ends shall be constructed of forged Type 316 stainless steel and valve ends shall be NPT threaded connections. The ball shall have a full bore port design machined from a solid metal piece with highly polished surfaces. The ball and stem shall be manufactured from Type 316 stainless steel. Manually operated ball valves shall be furnished with lever operators manufactured of forged Type 316 stainless steel with a molded vinyl sleeve. Stainless steel ball valves shall be Type 1000 Neles-Jamesbury screwed end ball valves, or an equal approved by the Engineer.

2.08 GATE VALVES

- A. Bronze Gate Valves: Gate valves installed aboveground, 2-inches in size and smaller, shall be Class 150 all bronze valves conforming to Fed. Spec. WW-V-54d, Type 1, Class B designed for a non-shock water pressure of 300 psi. Bronze for valve body and internals shall be in accordance with ASTM B16.18. Valves shall be furnished with screwed ends, handwheel operator, non-rising stem, one-piece solid wedge disc and screwed bonnet. Valves shall be as manufactured by Crane, Powell, or an approved equal. The minimum weight of valves shall be as follows:

<u>Valve Size (Inches)</u>	<u>Valve Weight (Pounds)</u>
1/2	1.0
3/4	1.5
1	2.5
1-1/4	3.6
1-1/2	4.6
2	7.6

- B. Iron Gate Valves:

1. Iron gate valves shall open by turning to the left (counter-clockwise), when viewed from the stem. When fully open, gate valves shall have a clear waterway equal to the nominal diameter of the pipe. Operating nut or hand wheel shall have an arrow cast in the metal indicating the direction of opening. Each valve shall have the manufacturer's distinctive marking, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by applying to it a hydrostatic pressure equal to twice the specified working pressure. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C500 or ANSI/AWWA C509, latest revisions, whichever is applicable.
2. Gate valves with nominal sizes from 2-to 2-1/2 inches shall conform to ANSI/AWWA C500, latest revision, and shall be designed for a minimum working pressure of 200 psi. Valves shall be iron body, bronze-mounted, double disc, parallel seat, non-rising stem type with double, Buna-N, O-ring stem seals. Bronze items of construction shall include the stems, seat rings, stem nuts, wedge bushings, and upper and lower wedges. Bronze used for construction of these items shall be low zinc alloy bronze. Valve ends shall be screwed and as specified for steel pipe and fittings. Interior ferrous surfaces of valve, except for finished or bearing surfaces, shall be coated with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-

free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating. Exterior surfaces shall be coated as specified hereinafter. Gate valves for this size range shall be as manufactured by American-Darling Valve Company, Kennedy Valve Manufacturing Company, or Dresser Industries, Inc.

3. Gate valves with nominal sizes from 3- to 16-inches shall conform to ANSI/AWWA C509, latest revision, and shall be designed for a minimum working pressure of 200 psi. Valves shall be iron body resilient seat type with O-ring stem seals. The valve stem, stem nut, glands, and bushings shall be bronze. Valve disc shall be constructed to assure uniform seating pressure between disc seat ring and body seating surface. Resilient seat of valve shall be formed by a special corrosion and chloramine resistant, synthetic elastomer, which is permanently bonded to and completely encapsulates, a cast iron valve disc. Valve ends for underground installation shall be mechanical joint as specified for ductile iron pipe and flanged for above-ground valves. Resilient-seated type gate valves shall be manufactured by American-Darling Valve Company, Kennedy Valve Manufacturing Company, or Dresser Industries, Inc.
4. Valve Joints: All gate valves shall have either mechanical joint, restrained joint, or flanged ends to fit the pipe run in which they are to be used. Gate valves installed on push-on joint pipe shall have mechanical joint ends unless otherwise specified.
5. Valve Operators: Unless otherwise shown on the Drawings or specified herein, gate valves shall have non-rising stems. Buried gate valves shall be furnished with a 2-inch square AWWA standard nut operator with a valve box and cover. Gate valves located aboveground or inside structures shall be furnished with a handwheel operator which shall have an arrow cast in the metal indicating the direction of opening. Gate valves used as isolation valves for reduced pressure backflow preventers shall be of the open screw and yoke (OS&Y) design with a handwheel operator.
6. Interior Valve Coating: Interior of the valve body shall be coated with a fusion bonded or thermo-setting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.
7. Exterior Valve Coatings: All exterior surfaces of iron body gate valves shall be clean, dry, and free from rust and grease before coating. For buried service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to back filling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal

to Koppers Bitumastic No. 300-M. For valves installed above-ground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust-inhibitive universal epoxy primer. Primer shall be suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with Section 09900: Painting.

2.09 BUTTERFLY VALVES

- A. General: As noted on the Drawings, butterfly valves for clean water service, 4-inches in size and larger, shall be Class 150-B in conformance with ANSI/AWWA C504, latest revision and designed for a minimum working pressure of 150 psi. Butterfly valves shall be of the tight closing rubber seat type. Valves shall be bubble tight with 150 psi on the upstream side of the valve and 0 psi on the downstream side and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the fully open position to the fully closed position. Butterfly valves shall be as manufactured by American-Darling Valve Company, Dresser Industries, Inc., Kennedy Valve Manufacturing Company, Mueller Company, DeZurik, or Henry Pratt Company.
- B. Valve Bodies: Valve bodies shall be constructed of high-strength cast iron conforming to ASTM A126, Class B. Buried valves shall have integrally cast mechanical joint ends as specified for ductile iron pipe and above-ground valves shall have cast iron flanges. End flanges shall conform in dimensions and drilling to ANSI B16.1, Class 125. Two Trunnions for shaft bearings shall be integral with each valve body. Valve body thickness shall be in strict accordance with ANSI/AWWA C504 latest revision for Class 150-B valves.
- C. Valve Seat Ring: Valve seat ring shall be constructed of Type 304 stainless steel. Seating edges of the seat ring shall be smooth and polished. The seat ring shall be capable of compensating for changes in direction of flow to assure a bubble tight seal in either direction.
- D. Valve Discs: Valve discs shall be solid (no cores) for 24-inch and smaller valves, and shall be either solid or hollow core for valves greater than 24-inch. Discs shall be constructed of ductile iron ASTM A536, Grade 65-45-12. Valve disc shall be of the offset design to provide 360 degree uninterrupted seating.
- E. Valve Shafts: Valve shafts may consist of a one piece unit extending completely through the valve disc bearings and into the operating mechanism or may be of the "stub shaft" type, which comprises two separate shafts inserted into the valve disc hubs. If used, stub shafts shall extend a minimum of 1-1/2 shaft diameters into the valve disc hubs. Valve shafts shall be constructed of ASTM A276, Type 304 stainless steel or a stainless steel with greater overall corrosion and oxidation resistance. The minimum shaft diameter shall conform to ANSI/AWWA C504,

latest revision for Class 150B valves. The valve disc shall be attached to the shaft by means of "O" ring sealed taper pins. The valve shaft seal shall consist of "O" rings in bronze cartridge or self adjusting nitrile Vee-type ring seals.

- F. Valve Seats: Valve seats shall be of a corrosion and chloramine resistant synthetic rubber compound bonded to a high grade stainless steel retaining ring and secured to the valve disc by Type 304 stainless steel set screws or shall be molded in, vulcanized, and bonded to the body. Seats bonded to the body shall withstand a 75-pound pull tested in accordance with ASTM D429, Method B. The valve seat shall be adjustable and replaceable in the field without dismantling operator, disc, or shaft.
- G. Valve Bearings: Valve shafts shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating (Nylon or Teflon). Bearings shall be designed for a pressure not exceeding the published design load for the bearing material, or 1/5 of the compressive strength of the bearing or shaft material.
- H. Valve Operators: All butterfly valves shall open left or counter-clockwise when viewed from the stem. Automatic valve operators shall have motorized valve actuators as specified hereinafter. Manual valve operators shall be of the worm gear or traveling nut type and shall be fully enclosed and suitable for buried or submerged service. All operators shall have adjustable mechanical stop limiting devices to prevent over travel of disc. Should an adjustment of the disc be required to maintain a bubble tight seal, this adjustment shall be made externally without removing the operator housing cover. The operator shall be designed such that all adjustments can be made under pressure and without the possibility of dirt getting into the operator lubricant. Any adjustments through the lower shaft will not be acceptable. Units furnished for buried service shall be fully gasketed and grease packed. Manual valves located above ground shall be equipped with handwheel or chainwheel operators and shall have a suitable indicator arrow to give valve position from fully open to fully closed. Buried butterfly valves shall be furnished with 2-inch square AWWA nut operator with valve box and cover. Operator components shall, at the extreme operator positions, withstand without damage a pull of 200 lbs. for handwheel or chainwheel operators or an input torque of 300 ft.-lbs. for operating nuts.
- I. Interior Valve Coating: Interior of valve body and valve disc except for valve seat and stainless steel valve seat ring shall be coated with a fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved, with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.
- J. Exterior Valve Coating: All exterior surfaces of butterfly valves shall be clean, dry, and free from rust and grease before coating. For buried or submerged service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to

backfilling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Koppers Bitumastic No. 300-M. For valves installed aboveground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust inhibitive, universal epoxy primer. Primer shall be suitable for finish paint specified. Following installation above-ground valves shall be finish painted in accordance with Section 09900: Painting.

- K. Valve Testing: Prior to shipment from the factory, hydrostatic and leakage tests shall be conducted for each butterfly valve. Hydrostatic and leakage tests shall be conducted in strict accordance with ANSI/AWWA C504, latest revision, and results shall be submitted to the Engineer.

2.10 SWING CHECK VALVES

- A. Swing check valves 2-inch through 16-inch in size shall conform to AWWA C508, latest revision, and shall be designed for a minimum water working pressure of 150 psi. Check valves shall have cast iron body, swing type and ends shall be flanged, Class 125 in accordance with ANSI B16.1. When open, the valve shall have a straight way passage with a minimum flow area equal to the full pipe area. Swing check valves shall be completely bronze fitted with renewable bronze seat ring and a rubber faced disc; valve hinge pin shall be stainless steel. Check valves shall be supplied with an outside lever and weight. The check valve bonnet shall be provided with a tapped boss with plug for future installation of a pressure gauge.
- B. The check valve for each pump shall be such that it opens smoothly on pump start-up and closes at a controlled rate of speed for the final predetermined portion of its stroke following pump shut-down. On start-up of the pump, the check valve disc shall open in response to the flow and then afford the minimum resistance to the flow. Upon pump shut-down, the valve's counterweight shall initiate the valve closure at an unrestricted rate until the valve disc reaches the pre-selected point of closure. The point at which the adjustable closing speed occurs shall be field-adjustable.
- C. Swing check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the downstream pressure. The check valve shall be constructed such that the disc and body seat ring may be easily removed and replaced without removing the valve from the line. Each valve shall be hydrostatically tested at the factory, at a test pressure of 300 psi.
- D. Interior Valve Coating: Prior to shipment from the factory, the interior ferrous surfaces of the valve, except for finished, non-ferrous, or bearing surfaces, shall be coated with a fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free, NSF approved,

with a minimum thickness of 16 mils. Surfaces shall be clean, dry, and free from rust and grease before coating.

- E. Exterior Valve Coating: All exterior surface of swing check valves shall be clean, dry, and free from rust and grease before coating. For valves installed in below-ground valve vaults, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Following installation, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M. For valves installed above ground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness of 4 mils, of a rust inhibitive, universal primer. Primer shall suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with Section 09900: Painting.
- G. Valve Manufacturer: Swing check valves shall be American-Darling 50 Line, M & H Style 159-02-0200, Kennedy Figure 106A-LW, or approved equal.

2.11 PLUG VALVES

- A. General: Plug valves shall be non-lubricated eccentric-type with flanged or mechanical joint ends as specified below. Valves shall open by turning to the left (counter-clockwise), when viewed from the stem. Port area of valves shall be a minimum of 80 percent of full pipe area. Valve pressure ratings, body flanges, and wall thicknesses shall be in full conformance with ANSI B16.1, latest revision. Valves shall seal leak-tight against full rated pressure in both directions. Prior to shipment from the factory, each valve shall be hydrostatically tested as follows. Valve seats shall be tested to provide leak tight shut off to 175 psi for valves through 12-inch and 150 psi for valves 14 inches and larger, with pressure in either direction. In addition, a hydrostatic shell test shall be performed with the plug open to a pressure twice that of rating specified above to demonstrate overall pressure integrity of the valve body. Plug valves shall be eccentric plug valves as manufactured by DeZurik, Henry-Pratt Co., or approved equal.
- B. Eccentric Plug Valves: Eccentric plug valves shall be Series 100 as manufactured by DeZurick, Henry-Pratt Co., or equal. Valve bodies shall be constructed of high strength cast iron conforming to ASTM A126, Class B and AWWA C504, latest revisions. Valve seats shall be formed by cast bodies with raised eccentric seats which have a corrosion-resistant welded-in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face or valve seats shall be replaceable 316 stainless steel seats. Valve seats shall be in accordance with AWWA C504 and AWWA C507, latest revisions. Valves shall be furnished with resilient faced plugs with neoprene facing, suitable for use with sludge. Valves shall be furnished with replaceable, permanently lubricated, stainless steel or fiberglass backed woven teflon fiber, sleeve-type bearings in the upper and lower plug stem journals. Plug stem bearings shall comply with AWWA C504 and

C507, latest revisions. Valves shall be bolted bonnet design. Valves shaft seals shall be designed so that they can be repackaged without removing the bonnet and the packing shall be adjustable. Packing material shall be Buna-Vee type packing. Valve shaft seals shall be in accordance with AWWA C504 and AWWA C507, latest revisions. All exposed valve nuts, bolts, springs, washers, and the like shall be Type 316 stainless steel.

- C. Interior Valve Lining: All interior ferrous surfaces of the valve that will have contact with sludge except the valve seating surfaces shall be coated with a factory applied, fusion bonded or thermosetting epoxy coating in accordance with AWWA C550, latest revision. Coating shall be holiday-free with a minimum thickness of 12 mils. Surfaces shall be clean, dry, and free from rust, oil, and grease before coating.
- D. Exterior Valve Coating: All exterior surfaces of plug valves shall be clean, dry and free from rust and grease before coating. For buried service, the exterior ferrous parts of all valves shall be coated at the factory with coal tar epoxy with a minimum total finish dry film thickness of 20 mils. Prior to backfilling, all uncoated nuts, bolts, glands, rods, and other parts of joints shall be coated in the field with coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M. For valves installed aboveground, the exterior ferrous parts of all valves shall be shop primed at the factory with one coat, minimum dry film thickness 2 - 3.5 mils, of a lead and chromate-free primer with rust-inhibitive pigments and synthetic resins. Primer shall be suitable for finish paint specified. Following installation, above-ground valves shall be finish painted in accordance with Section 09900: Painting.
- E. Valve Joints: All plug valves installed above ground, in valve vaults, or on flanged piping shall have flanged ends as specified for ductile iron pipe. Flanges shall comply with facing, drilling, and thickness of ANSI Standards for Class 125 dimension. All buried plug valves shall have mechanical joint ends as specified for ductile iron pipe.
- F. Valve Operators:
 - 1. Unless otherwise noted, plug valves installed in valve vaults or buried underground shall have gear actuators with 2-inch square nut designed for buried and submerged service. Valve shall have seals on all shafts and gaskets on valve and actuator covers to prevent entry of water and dirt. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed valve nuts, bolts, springs, washers, and the like shall be Type 316 stainless steel.
 - 2. Unless otherwise noted, above-ground plug valves 6-inches in size and larger shall be furnished with mechanical gear actuators furnished with handwheel, chainwheel, or 2-inch square nut operators, as shown on the Drawings. Gear actuator shall be sized for the maximum pressure

differential across the valve, equal to the pressure rating of the valve. All gearing shall be enclosed in a high-strength cast iron housing, suitable for running in a lubricant. Housing shall be provided with seals on all shafts to prevent the entry of dirt and water into the actuator. Actuator shaft and quadrant shall be supported on permanently lubricated bronze bearings. Actuator shall clearly indicate valve position for above-ground and valve vault installations and an adjustable stop shall be provided to set closing torque. Actuator shall be capable of withstanding an over-torque without damage up to 450 foot-pounds for 2-inch square nut operators and to 300 foot-pounds for handwheel or chainwheel operators.

3. Four-inch and smaller aboveground valves shall be furnished with manual actuators, one-quarter turn to open. Actuator shall be supplied with an AWWA Standard 2-inch operating nut with a standard valve operating lever.

2.12 FOOT VALVES

- A. Foot valves shall be of the type designed to provide silent operation, positive sealing, and full flow area.
- B. Valves shall be flanged, 125 lb., ANSI standard and of the center-guided, poppet-type, having a linear stroke to provide silent operation. Guide shafts, bushings, seat, and disc shall be stainless steel. The Buna-N seal shall be so designed to provide an initial contact of bronze to Buna-N with final contact being metal to metal to prevent destruction of the Buna-N seal ring.
- C. Flow area through the valve, including valve stroke, shall be equal to pipe size.
- D. Valve inlet shall be provided with stainless steel screening. The screening should in no way reduce the full flow area of the valve. The screening shall be in the shape of a basket with the bottom also screened.
- E. Standard construction to be cast iron body, bronze trim with stainless steel basket screening.
- F. Valve to be as manufactured by the Val-Matic Valve & Mfg. Corp., Series 1900, or approved equal.

2.13 AUTOMATIC AIR RELEASE VALVES

- A. Clean Water Air Release Valves:
 1. Small Valves: Valves 3/4-inch and smaller shall be simple-lever type with cast iron body ASTM A48, Class 35, 316 stainless steel trim, and viton orifice button. Valves shall have a working pressure rating of at least 150

P.S.I. Valves shall be Valmatic Model 15, APCO Model 55, 65, or approved equal.

2. Large Valves: Valves 1-inch or larger shall have heavy duty compound lever operating mechanism with 316 stainless steel pivot pins and 316 stainless steel retaining rings. Valves shall be constructed of cast iron ASTM A48, Class 35 with 316 stainless steel trim and float. Valves shall have an adjustable orifice button, constructed of 316 stainless steel with viton or Buna-N seating. Provide 1/2-inch threaded outlet and stainless steel plug for top cover and body drain. Valves shall have a working pressure rating of at least 300 P.S.I. Valves shall be Valmatic Model 38, APCO Model 200A, 207, or approved equal.

B. Wastewater Air Release Valves:

1. Wastewater air release valves shall be 2-inch simple lever-type with cast iron body ASTM A-48, Class 35, 316 stainless steel trim and float, and viton orifice button. Valves shall have a working pressure of at least 150 psi. Valves shall be Valmatic Model 48, APCO Model 400, or approved equal.

C. Valve End Connections:

1. Valves smaller than 3-inches shall have threaded ends. Valves 4-inches or larger shall have flanged ends.
2. Flanges for Class 150 valves shall comply with ANSI B16.1, Class 125. Flanges for Class 300 valves shall comply with ANSI B16.1, Class 250.
3. Threaded ends shall comply with ANSI B2.1

- D. All air release and vacuum relief valves shall be isolated from the service line with a 316 stainless steel gate valve.

2.14 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Service saddles shall have ductile iron bodies in accordance with ASTM A536, latest revision, with double stainless steel straps. Ductile iron body shall have a fusion-bonded nylon coating with a minimum thickness of 12 mils. Straps shall be Type 316 stainless steel with premium grade Type 316 L stainless steel bolts and Type 316 stainless steel washers and nuts. The nuts shall be Teflon coated. The gasket material shall be an elastomeric compound resistant to degradation by oil, natural gas, acids, alkalies, most aliphatic fluids, and chloramines. The outlet of the saddle shall have NPT threads. Service saddles shall be Rockwell No. 317 or an equal approved by the Engineer.

2.15 SOLENOID VALVES

- A. Water Service. Solenoid valves shall be 2-way type for normally closed operation designed for not less than a 150 psi water working pressure. Valves less than 3 inches shall have forged brass bodies. Three-inch valves shall have aluminum bodies. Valves shall have NPT threaded ends, stainless steel wetted parts, Buna N seals/disks, and NEMA 4X solenoid enclosures. The valves shall operate on 120 VAC power, shall have threaded conduit hubs, standby manual operators and shall not require a minimum operating pressure differential for steady operation. The valves shall be manufactured by Automatic Switch Company (ASCO Red Hat), or approved equal.
- B. Diesel Fuel Service: Solenoid valves for diesel fuel service shall be two-way, 120-volt, 60 HZ normally closed, with a brass body, NPT threaded ends, stainless steel wetted parts, explosion proof enclosure, manual operator, and viton diaphragms and seals. The valves shall be as manufactured by the Automatic Switch Company (ASCO Red Hat), or approved equal.

2.16 FLANGED ADAPTER COUPLING

- A. Adapters shall be suitable for joining plain-end pipe to flanged pipes and fittings. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections (ANSI B16.1 125 lb./ANSI B16.5 150 lb.).
- B. Adapters shall be constructed of steel and coated in accordance with Section 09900. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8 for bolts, and ASTM A194, Grade 8 for nuts and washers. Bolts and nuts greater than 1-1/8 inches in diameter shall be carbon steel ASTM A307, Grade B, with Cadmium plating, ASTM A165, Type NS. Gasket material shall be suitable for exposure to the liquids to be contained within the pipes.
- C. Adapters shall be Dresser style 128 or equal.

2.17 UNI-FLANGE® FLANGE ADAPTERS

- A. Adapters shall be suitable for joining plain-end pipe to flanged pipes and fittings. Adapters shall conform in size and bolt hole placement to ANSI standards for steel and/or cast iron flanges 125 or 150 pound standard unless otherwise required for connections (ANSI B16.1 125 lb./ANSI B16.5 150 lb.).
- B. Adapters shall be constructed of ductile iron in accordance with ASTM A536 grade 65-45-12 and coated in accordance with Section 09900. Bolts and nuts shall be Type 316 stainless steel conforming to ASTM A193, Grade B8 for bolts, and ASTM A194, Grade 8 for nuts and washers. Bolts and nuts greater than 1-1/8

inches in diameter shall be carbon steel, ASTM A307, Grade B, with cadmium plating, ASTM A165, Type NS. Set screws shall be AISI 4140 steel 190,000 psi, heat treated to Rockwell C42-50, and zinc plated for corrosion resistance.

- C. Provide limit restraint/thrust bolt harness assemblies if required based upon piping system test pressure.
- D. Adapters shall be Uni-flange[®] Series 400 adapter flange by the Ford Meter Box Company, Inc. for above-ground and below-ground piping with diameters of 2-inches through 48-inches.

2.18 FLEXIBLE EXPANSION JOINTS

- A. Flexible expansion joints shall be of the molded wide double arch design manufactured of neoprene rubber with polyester and steel reinforcement. Neoprene body shall be supplied with a Hypalon coating. Joints shall be flanged suitable for 150 psi water working pressure and in accordance with ANSI B16.1 dimensions and bolting patterns. Flanged ends shall be furnished with galvanized, split ductile iron retaining rings.
- B. Provide limit restraint bolts on all lines. Expansion joints 6-inches and larger in size shall have a minimum of four limit restraint bolts. Restraint bolts and nuts shall be Type 316 stainless steel.
- C. Minimum performance for flexible expansion joints shall be as follows:

Size (In.)	Axial Compression (Inches)	Axial Elongation (Inches)	Lateral Deflection (Inches)	Angular Deflection Degrees
2	7/8	1/2	1	30
4	7/8	1/2	1	30
6	7/8	1/2	1	25
8	1-3/8	3/4	1	25
10	1-3/8	3/4	1	20
12	1-3/8	3/4	1	20
24	1-5/8	7/8	1	20

- D. Flexible expansion joints shall be Redflex as manufactured by Redvalve, Style 1015, Maxi-Joint as manufactured by General Rubber Corporation, Style 100, Metrasphere as manufactured by the Metraflex Company, or an equal approved by the Engineer.

2.19 PRESSURE GAUGE ASSEMBLIES

- A. Pressure gauges shall have the following design features: silicone oil filled, 4-inch aluminum dial with black numerals on white background, Type 316 stainless steel bourdon tube and internal movement, 330 series stainless steel case and ring, safety glass lens, threaded lens retaining ring, adjustable pointer, either friction or gear adjustable, blowout protection, 1/2-inch Type 316 stainless steel stem mounting, and 1.0 percent accuracy based on full scale. No stop pins shall be permitted on the dial face. Internal stop pins shall be required to prevent the sector gear from becoming disengaged from the geared needle post as a result of over or under pressure range. Provide Type 316 stainless steel pressure snubbers on all gauges not protected by diaphragm seals. Provide a supply of replacement fill liquid for all gauges supplied for the entire Project. Pressure gauges shall be as manufactured by U.S. Gauge, Ashcroft, Marshalltown, Marsh, Wika, or approved equal.
- B. Pressure Gauge Service and Ranges: Pressure gauges shall be furnished for the following services with the indicated ranges. Diaphragm seals shall be furnished for gauges as indicated. This table is for the contractor's convenience only, and may not depict all systems or all services that require gauges.

<u>Service</u>	<u>Number Required</u>	<u>Range</u>	<u>Diaphragm Seal</u>
RAS Pumps	1	0-50 psi	Yes
WAS Pumps	1	0-50 psi	Yes
In-plant Pump Station	1	0-50 psi	Yes
Effluent Transfer Pumps	1	0-50 psi	No

- C. Diaphragm seal (pipe sizes 12-inch and smaller): Pressure gauges for dirty water service shall be furnished with diaphragm type protection seals. Diaphragm protection seals for pipe sizes 12-inches and smaller shall provide full 360° pressure sensing through a flexible rubber sleeve. Rubber sleeve shall be constructed of Buna-N. Sensor body exterior shall be Teflon coated carbon steel with ANSI B16.5 Class 150 flanges. Sensing fluid shall be ethylene glycol and water. Pressure sensor shall be as manufactured by Red Valve Series 40 or approved equal.
- D. Diaphragm Seal (pipe sizes 14-inch and greater): Pressure gauges for dirty water service shall be furnished with diaphragm protection seals which shall be joined to the pressure gauges and filled at the manufacturer's factory. The seals shall be the removable design such that the bottom member can be removed for cleaning without disturbing the diaphragm. The diaphragm shall be Type 316 stainless steel. The top and bottom members of the seal shall be Type 316 stainless steel. Connections for both the gauge and the bottom connection shall be 1/2-inch female NPT threaded connections. The bottom member shall have a 1/2-inch plugged flushing connection with a Type 316 stainless steel plug. Liquid filling for the diaphragm seals shall be silicone oil. Provide a supply of replacement fill

liquid for all diaphragm seals supplied for the entire Project. Diaphragm protection seals shall be supplied by the manufacturer of the gauge.

- E. Each pressure gauge assembly shall be furnished with an isolation ball valve. Body, stem, and all other parts of valves shall be manufactured of Type 316 stainless steel. Valve packing shall be high-density TFE. Valve connections shall be 1/2-inch female NPT threaded connections. Ball valves for pressure gauge assembly isolation shall be 45 Series as manufactured by the Whitey Company, or an equal approved by the Engineer.

2.20 VALVE AND METER VAULTS

- A. Valve and meter vaults shall be constructed of precast or cast-in-place concrete with dimensions as shown on the Drawings. Concrete shall conform to the requirements of Section 03410: Precast Concrete Structures. Concrete shall have a minimum compressive strength of 4,000 psi at 28 days. The steel reinforcement for the structures shall be designed and constructed to withstand the loads expected.
- B. The cover for the meter vault shall be a watertight aluminum access frame and cover as specified in Section 08350: Access Hatch Doors.

2.21 VALVE BOXES

- A. Furnish, assemble, and place a valve box over the operating nut for each buried valve. The valve box shall be designed so as to prevent the transmission of surface loads directly to the valve or piping.
- B. Valve boxes shall be of the adjustable slide-type of suitable length with an interior diameter of not less than 5-inches. The valve boxes shall be manufactured of cast iron and shall be of the two piece design including a bottom section and top section with cover. The cast iron cover shall be cast with the applicable service, "WATER," "SEWER," "REUSE," etc., markings. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below finished grade.
- C. The castings shall be manufactured of clean, even grain, gray cast iron conforming to ASTM A48, Class 30B for Gray Iron Castings; and shall be smooth, true to pattern, free from blow holes, sand holes, projections, and other harmful defects. The seating surfaces of both the cover and the top section shall be machined so that the cover will not rock after it has been seated.
- D. The valve boxes shall be coated inside and outside with an asphaltic coating prior to machining, so that the machined seating surfaces will be free of any coating. Cast iron valve box assemblies shall be Clow Corp. No. F-2452, Tyler Corp. Series 6855 or 6865, or an approved equal. Valve extension stems shall be

provided for all buried valves when operating nut is deeper than 3-feet below final grade.

2.22 PIPE AND VALVE IDENTIFICATION SYSTEMS

- A. Identification systems for above-ground and below-ground piping and for valves shall be as specified under Section 09905 of these Specifications.

2.23 SEDIMENT STRAINERS

- A. Sediment strainers shall be Y-type manufactured of transparent Type 1, Grade 1 PVC with threaded or solvent welded socket ends. Screen for strainers shall be 20 mesh Type 316 stainless steel. The screen shall be easily removed for cleaning or replacement from the filter body without removing the body from the pipeline. The bonnet seal shall be EPDM "O" rings. The sediment strainers shall have a pressure rating as follows:

<u>Strainer Size</u>	<u>Water Non-Shock Pressure Rating</u>
1/2-inch to 1 inch	150 psi @ 70 Degrees F
1 1/2-inch to 2 inch	90 psi @ 70 Degrees F
3 inch to 4 inch	60 psi @ 70 Degrees F

- B. Sediment strainers shall be manufactured by Asahi/America, or an equal approved by the Engineer.

2.24 TIE RODS

- A. When prior approval is obtained from the Engineer, ductile iron pipe, fittings, and valves may be restrained using tie bolt joint restraint. Joint restraint materials for this method of restraint shall be the Super-Star SST Series Joint Restraint System as manufactured by Star National Products, a Division of Star Industries, Inc. Columbus, Ohio, or an equal approved by the Engineer.
- B. All bolts, nuts, washers, tie rods, and other fasteners for the joint restraint system shall be manufactured of CORTEN high strength, low alloy, corrosion-resistant steel in conformance with ASTM A242. Tie bolts shall be manufactured of heat treated CORTEN steel. Tie rods and all fasteners for the system shall be galvanized in conformance with the requirements of ASTM A123. Tie rods shall have a minimum diameter of 3/4-inch. The number of tie rods required per joint shall be as recommended by the manufacturer.
- C. Prior to backfilling after installation, all parts of the joint restraint system shall be coated with coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M, for a minimum dry film thickness of 20 mils.

2.25 SAFETY SHOWER AND EYE WASH

- A. Emergency Shower and Eye Wash: Provide a Haws Model 8330, all stainless steel free-sanding shower and eye/face wash, or equal. Furnish complete with deluge shower head, 1 1/4-inch full flow ball valve actuated by pull rod and ring, hand and foot operated stainless steel, aerated eye/face wash stanchion, floor flange, and interconnecting fittings. Provide a 1 1/2-inch supply inlet, and 1 1/4-inch waste tee.
- B. All exposed emergency shower piping to be insulated with 1/2-inch thick closed cell tubing insulating per ASTM C534, Type 1. Paint insulation with 2 coats semigloss water base paint, specifically recommended for weather protection, Rubatex R-18OFS Insulation, Rubatex 374 Coating, or equal. Install as shown on the Drawings.
- C. Emergency Water Alarm (EWA)
 - 1. Emergency water alarm units and components shall be furnished and installed in conjunction with "Emergency Showers" where shown on the Drawings and equal to Haws Drinking Faucet Company, Model 9000 Alarm, or Western Safety Equipment complete with alarm, light, protective grid, and flow switch.
 - 2. Furnish the light-gong units for installation under Division 16.
 - 3. Wiring between flow switches and light-gong units will be done under Division 16 including furnishing and installing a relay and reset button for each Emergency Alarm Station.
 - 4. Electrical characteristics for this unit are 115 volts, single phase, 60 Hz.
 - 5. Control valves adjacent to flow alarm switches shall be fitted gated valves with bronze lock shields.
 - 6. The actual location of the alarm light-gong units will be set at the job site by the Engineer and the flow switches in the piping system shall be in accordance with the manufacturer's recommendation.

2.26 EXTENDED DEFLECTION AND EXTENDING COUPLING

- A. The extended deflection and extending coupling shall consist of a telescoping sleeve and two pipe ball joints. The entire assembly shall be manufactured of ductile iron and shall be a restrained joint system. The deflection capability of the pipe ball joints shall be 15 degrees. The assembly shall be shipped preassembled with a non-water soluble lubricant meeting the requirements of the National

Sanitation Foundation Standard NFS-61 and shall be encased with polyethylene encasement. The assembly shall be installed with the polyethylene encasement left in place on the assembly to prevent backfill material from impeding the elongation and contraction capabilities of the assembly during service.

- B. The extended deflection and extending coupling unit shall be TR FLEX[®] Telescoping Sleeve and USIFLEX[®] Joints as manufactured by U.S. Pipe and Foundry Company, Inc., FLEX-TEND[®] Flexible Expansion Joints as manufactured by EBAA Iron Sales, Inc., or approved equal.

2.27 FLOOR DRAINS

- A. Floor drains shall be constructed of corrosion-resistant high density polyethylene with removable round polyethylene strainer to allow for cleaning.
- B. Floor drain piping shall be constructed of PVC pipe with a 4-inch deep seal (P-trap).

2.28 POLYETHYLENE PIPE ENCASEMENT

- A. Polyethylene tube encasement shall be provided and installed for buried ductile iron pipe segments and fittings indicated on the Drawings or specified herein. Both material and installation procedures shall be in accordance with AWWA C105.
- B. The polyethylene encasement shall be a minimum of 8 mil thick and shall be certified by the manufacturer to provide suitable protection of pipe installation in corrosive soil.
- C. The contractor shall install polyethylene encasement in accordance with all liner and pipe manufacturer recommendations.

2.29 HOSE BIB (AS SHOWN ON THE DRAWINGS)

2.30 WASHDOWN HOSE

- A. Hoses shall be 50-feet long, 1-inch diameter abrasion and weather resistant (0.47 lb/LF) EPDM red cover, rayon braided hose with 8-inch adjustable brass hose nozzle on discharge end and 1-inch stainless steel male x female (NPT) QF series quick connect coupling on supply end. All components shall be manufactured by Amazon Hose & Rubber Company, or approved equal.

2.31 MISCELLANEOUS ITEMS

- A. Other items necessary for the complete installation and not specified herein shall conform to the details and notes shown on the Drawings. All minor items implied, usually included, or required for the construction of a complete operating system shall be installed whether shown on the Drawings or not.

PART 3 - EXECUTION

3.01 INSPECTION

- A. All pipe, fittings, valves, and other material shall be subject to inspection and approval by the Engineer after delivery, and no broken, cracked, imperfectly coated, or otherwise damaged or unsatisfactory material shall be used. When a defect or crack is discovered, the injured portion shall not be installed. Cracked pipe shall have the defect cut off at least 12-inches from the break in the sound section of the barrel.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Excavation, backfill, and compaction shall conform to the provisions of Section 02220. Upon satisfactory installation of the pipe bedding material as specified in Section 02220, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
- B. Cover for underground piping shall not be less than that indicated on the Drawings. The minimum cover for pipe shall be 30-inches. In areas where other piping conflicts preclude the maximum cover desired, the piping shall be laid to provide the maximum cover obtainable.
- C. Pipe, fittings, valves, and accessories shall be installed as shown or indicated on the Drawings.
- D. All connections to existing piping systems shall be made as shown or indicated on the Drawings after consultation and cooperation with authorities of the Owner. Some such connections may have to be made during off-peak hours (late night or early morning).
- E. Pipe Joint Deflection: Whenever it is desirable to deflect pipe joints to avoid obstructions or to maintain required alignment, the amount of the joint deflection shall not exceed 80 percent of the maximum limits allowed by the pipe manufacturer.

- F. In preparation for pipe installation, placement (stringing) of pipe should be as close to the trench as practical on the opposite side of the trench from the excavated material. The bell ends of the pipe should point in the direction of the work progress.
- G. Pipe and fittings shall be laid accurately to the lines and grades indicated on Drawings or required. Where grades for the pipeline are not indicated on the Drawings, maintain a uniform depth of cover with respect to finish grade. Care shall be taken to insure a good alignment both horizontally and vertically and to give the pipe a firm bearing along its entire length. Any pipe, which has its grade or joint disturbed after being laid, shall be taken up and relaid.
- H. All pipes and fittings shall be cleared of sand, dirt, and debris before laying. All precautions shall be taken to prevent sand, dirt, or other foreign material from entering the pipe during installation. If necessary, a heavy, tightly woven canvas bag of suitable size shall be placed over each end of the pipe before lowering into the trench and left there until the connection is made to the adjacent pipe. Any sand, dirt, or other foreign material that enters the pipe shall be removed from the pipe immediately. Interior of all pipe and fittings shall be kept clean after installation until accepted in the complete work.
- I. Any time that pipe installation is not in progress, the open ends of pipe shall be closed by a watertight plug or other method approved by the Engineer. Plugs shall remain in pipe ends until all water is removed from the trench. No pipe shall be installed when trench conditions are unsuitable for such work, including standing water, excess mud, or rain.
- J. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place while conducting the preliminary hydrostatic test. No backfill shall be placed over the joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.
- K. Upon satisfactory completion of the hydrostatic test, backfilling of the trench shall be completed.
- L. Above-ground and Exposed Piping: Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipelines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated or as required to insure adequate support of the piping.

3.03 INSTALLATION OF DUCTILE IRON PIPE

A. INSPECTION AND TESTING

1. All pipe shall be inspected and tested at the foundry.
2. The Owner shall have the right to have any or all piping, fittings, or special castings inspected and tested by an independent testing agency at the foundry or elsewhere. Such inspection and testing will be at the Owner's expense.
3. Mark as rejected and immediately remove from the job site, all pipe lengths showing a crack, damaged lining, or receiving a severe blow that may cause an incipient fracture, even though no such fracture can be seen.
4. Removal of cracked portions: Any pipe showing a distinct crack, but no incipient fracture beyond the limits of the visible crack, may be cut off and the sound portion installed. Cut the pipe at least 12-inches from the visible limits of the crack. Cutting of pipe shall be done by skilled workmen, and in such a manner as to not damage the pipe. Every cut shall be square and smooth, with no damage to the pipe lining. Cut surfaces shall be recoated as specified for the pipe. Cutting and installing cracked pipe shall only be performed when approved by the Engineer, and shall be at the expense of the Contractor.

B. Handling and Cutting Pipe:

1. Care shall be taken in handling, cutting, and laying ductile iron pipe and fittings to avoid damaging the pipe and interior coal tar epoxy or cement mortar lining, scratching or marring machined surfaces, and abrasion of the pipe coating. All cracked pipe and fittings shall be removed at once from the Work at no additional cost to the Owner.
2. Pipe cutting shall be done in a neat workmanlike manner without creating damage to the pipe and interior coal tar epoxy or cement mortar lining. Ductile iron pipe may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw or oxyacetylene torch. Cut ends and rough edges of ductile iron pipe shall be ground smooth. For push-on joint connections, the cut end shall be beveled to prevent gasket damage during joint assembly. Interior lining shall be repaired at cut ends per the manufacturer's instructions prior to joint assembly.

C. Laying Pipe and Fittings:

1. Bedding for Ductile Iron Pipe: Minimum bedding requirements shall be Type 2 as defined in ANSI/AWWA C600, latest revision. Provide proper

bedding required, in accordance with thickness class of pipe being laid and depth of cover. Proper pipe laying conditions shall be in accordance with ANSI/AWWA C150 and C151, latest revisions, and ANSI/AWWA C600, latest revision.

2. All ductile iron pipe and fittings shall be laid in accordance with American Water Works Association Standard ANSI/AWWA C600, latest revision, entitled "Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances," with the following sections specifically applying:
 - a. Section 3.3 - Pipe Installation
 - b. Section 3.4 - Joint Assembly

D. Ductile Iron Pipe Joints:

1. Type: The joints of all pipelines shall be made absolutely tight. The particular joint used shall be approved by the Engineer prior to installation. Where shown on the Drawings or where, in the opinion of the Engineer, settlement or vibration is likely to occur, all pipe joints shall be bolted mechanical type or restrained type as specified above, or as indicated on the Drawings.
2. Push-on Joints: Push-on joints shall be made in strict accordance with the manufacturer's recommendations. Lubricant, if required, shall be an inert, non-toxic, water soluble compound incapable of harboring, supporting, or culturing bacterial life. Manufacturer's installation recommendations shall be submitted to the Engineer for review and approval before commencing work. The bell of the pipe shall be cleaned of excess tar or other obstructions and wiped out before the cleaned and prepared spigot of the next pipe is inserted. The new pipe shall be shoved firmly into place until properly seated and held securely until the joint has been completed.
3. Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer for review and approval before work is begun. Only specially skilled workmen shall be permitted to make up mechanical joints. Torque wrenches, set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used with the permission of the Engineer.
4. Restrained Joints: Restrained joints shall be provided where indicated on the Drawings. Joint assembly shall be made in strict accordance with the manufacturer's instructions, which shall be submitted to the Engineer for review and approval before commencing work.

5. Flanged Joints: Flanged joints shall be made up by inserting the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with suitable lubricant immediately before installation.
 - a. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing and lubricate bolts with oil and graphite.
 - b. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
 - c. Execute care when tightening joints to prevent undue strain upon valves, pumps, and other equipment.
 - d. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

3.04 INSTALLATION OF PVC PIPE

A. Storage and Handling:

1. PVC pipe shall be delivered to the site in unbroken bundles packaged in such manner as to provide protection against damage. When possible, pipe should be stored at the job site in the unit packages until ready for use. Packaged units shall be handled using a forklift or a spreader bar with fabric straps. Packaged units shall not be stacked at the job site higher than two units high.
2. When it is necessary to store PVC pipe for long periods of time, exposure to direct sunlight shall be prevented by covering the pipe with an opaque material. Adequate air circulation above and around the pipe shall be provided as required to prevent excessive heat accumulation. PVC pipe shall not be stored close to heat sources or hot objects such as heaters, fires, boilers, or engine exhaust. Pipe gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil, and grease. The interior and all sealing surfaces of pipe, fittings, and other appurtenances shall be kept clean and free of dirt and foreign matter.
3. Care shall be taken in handling and laying pipe and fittings to avoid severe impact blows, crushing, abrasion damage, gouging, or cutting. Pipe shall be lowered, not dropped, from trucks or into trenches. All cracked, damaged, or defective pipe and fittings, or any length of PVC pipe having a gouge, scratch, or other permanent indentation of more than 10 percent

of the wall thickness in depth, shall be rejected and removed at once from the work and replaced with new acceptable pipe at no additional cost to the Owner.

- B. Field Cutting PVC Pipe: Field cutting of pipe shall be done in a neat workmanlike manner without creating damage to the pipe. The pipe shall be cut square with a fine-toothed hand or power saw or other cutter or knife designed for use with plastic pipe. Prior to cutting, the pipe shall be marked around its entire circumference or a square-in vise shall be used to ensure the pipe end is cut square. Remove burrs by smoothing edges with a knife, file, or sandpaper.
- C. Field Cutting Bell and Spigot PVC Pipe: Bevel the cut end of the pipe using a pipe beveling tool, wood rasp, or portable sander to prevent damage to the gasket during joint assembly. A factory-finished beveled end should be used as a guide to ensure proper beveling angle and correct depth of bevel. Round off any sharp edges on the leading edge of the bevel with a knife or file.
- D. Laying PVC Pipe:
 - 1. Pipe Bedding: Bedding for PVC pipe shall be as specified in Section 02220 using granular pipe bedding material.
 - 2. All PVC pipe shall be laid in accordance with the pipe manufacturer's published installation guide, the AWWA Manual of Practice No. M23 "PVC Pipe - Design and Installation" and the Uni-Bell Plastic Pipe Association installation recommendations.
- E. PVC Pipe Joint Assembly for Rubber Gasketed Bell and Spigot Pipe:
 - 1. The PVC bell and spigot joint shall be assembled in accordance with the pipe manufacturer's installation instructions, ASTM D2774, and AWWA Manual M23. Clean the interior of the bell, the gasket, and the spigot of the pipe to be jointed with a rag to remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation.
 - 2. Lubricate the spigot end of the pipe with a lubricant supplied or specified by the pipe manufacturer for use with gasketed PVC pipe in potable water systems. The lubricant should be supplied as specified by the pipe manufacturer. After the spigot end is lubricated, it must be kept clean and free of dirt and sand. If dirt and sand adhere to the lubricated end, the spigot must be wiped clean and relubricated.
 - 3. Insert the spigot into the bell so that it contacts the gasket uniformly. Align the pipe sections and push the spigot end into the bell until the manufacturer's reference mark on the spigot is flush with the end of the

bell. The pipe should be pushed into the bell using a bar and wood block. The joint shall not be assembled by "stabbing" or swinging the pipe into the bell, nor shall construction machinery be used to push the pipe into the bell.

4. If undue resistance to insertion of the spigot end is encountered or if the reference mark does not reach the flush position, disassemble the joint and check the position of the gasket. If the gasket is twisted or pushed out of its seat, inspect the components, repair or replace damaged items, clean the components, and repeat the assembly steps. Be sure the pipe is in proper alignment during assembly. If the gasket was not out of position, check the distance between the spigot end and the reference mark and relocate the mark if it is out of position.

F. PVC Pipe Joint Assembly for Threaded and Solvent Welded Pipe:

1. All threaded and solvent welded joints shall be made watertight in accordance with ASTM D2855, ASTM D2564, and AWWA Manual M23. All pipe cutting, threading, and jointing procedures for threaded and solvent welded PVC pipe joints shall be in strict accordance with the pipe and fitting manufacturer's printed installation instructions. Thread lubricant for threaded joints shall be Teflon tape only.
2. At threaded joints between PVC and metal pipes, the metal side shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.

3.05 INSTALLATION OF STEEL PIPE

- A. Threads shall be neatly cut with sharp tools, and the jointing procedure shall conform to the best practice of the trade. After cutting, all pipe shall be reamed. All pipe shall be screwed together with an application of approved lubricant applied to male threads, and once a joint has been tightened, it shall not be backed-off unless the threads are recleaned and new lubricant applied. Application shall be neatly made and all excess lubricant and dirt shall be thoroughly wiped off the inside of every joint.
- B. All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M.

3.06 FITTING INSTALLATION FOR UNDERGROUND PIPING

- A. The weight of ductile iron fittings shall not be carried by the pipe on which they are installed. The fitting shall be supported by a concrete cradle as shown on the standard details. Concrete used for supports shall have a minimum compressive

strength of 3,000 psi at 28 days. Concrete for the support cradle shall be poured against undisturbed soil.

- B. All glands, clamps, bolts, nuts, studs, and other uncoated parts of fitting joints for underground installation shall be coated with two coats, 10 mils DFF per coat, of coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M.

3.07 CONCRETE PIPE ENCASEMENT

- A. Concrete for concrete pipe encasement shall have a minimum strength of 3,000 psi at 28 days and encasement shall be constructed in accordance with details shown on the Drawings. Encasement shall be constructed where:
 - 1. Indicated on the Drawings.
 - 2. The Engineer shall order the pipeline encased.
- B. The points of beginning and ending of concrete pipe encasement shall be not more than 6-inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.
- C. Pipe encasement shall provide a minimum coverage of 6-inches all around the pipe including pipe bells.

3.08 INSTALLATION OF PIPE SLEEVES, WALL CASTINGS, AND COUPLINGS

- A. Pipe sleeves and wall castings shall be provided at the locations called for on the Drawings. These units shall be as detailed and of the material as noted on the Drawings. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the walls are poured. Ends of all wall castings and wall sleeves shall be of a type consistent with the piping to be connected to them.
- B. Link seals for wall sleeves shall be installed in strict accordance with the manufacturer's printed installation instructions. For watertight applications in tanks or treatment units, the link seal installation shall be tested hydrostatically for leaks at the same time as the tank or treatment unit. Any leaks that occur during the test period shall be repaired by checking the link seals for proper installation and replacement of unit(s) found to be defective at no additional cost to the Owner.
- C. Pipe couplings shall be installed in strict accordance with the manufacturer's published instructions and recommendations.

3.09 INSTALLATION OF VALVES

- A. Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with manufacturer's installation instructions and with the details shown on the Drawings.
- B. Valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain. Valves shall be installed such that their weight is not borne by pumps and equipment that are not designed to support the weight of the valve.
- C. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Check and adjust all valves for smooth operation.
- D. Install valves with the operating stem in either horizontal or vertical position.
- E. Allow sufficient clearance around the valve operator for proper operation.
- F. Clean iron flanges by wire brushing before installing flanged valves. Clean carbon steel flange bolts and nuts by wire brushing, lubricate threads with oil or graphite, and tighten nuts uniformly and progressively. Clean threaded joints by wire-brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- G. For buried valves, a valve box shall be centered accurately over the operating nut and the entire assembly shall be plumb. The tops of valve boxes shall be adjusted to the proper elevation as specified below and as shown on the Drawings.
 - 1. In paved areas, tops of valve box covers shall be set 1/4-inch below pavement. Following paving operations, an 18-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and an 18-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the Drawings. Concrete for the pad shall be 3,000 psi compressive strength at 28 days.
 - 2. In unpaved areas, tops of valve box covers shall be set 2-inches above finished grade. After the top of the box is set to the proper elevation, an 18-inch square by 6-inch thick concrete pad shall be poured around the box cover. Concrete for the pad shall be 3,000 psi compressive strength at 28 days.

3. The concrete pad for the valve box cover shall have a 3-inch diameter bronze identification disc embedded in the concrete surface as shown on the Drawings. The bronze identification disc shall be as specified in Section 09905 and shall have the information as shown on the Drawings neatly stamped on it.
- H. Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure used for the pressure test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and hydrostatically retest the joints.
- I. Following installation, all above-ground valves shall be painted in accordance with the painting system specified in Section 09900: Painting. Following installation of buried valves or valves installed in valve vaults, repair any scratches, marks and other types of surface damage, etc., with a coating equal to the original coating supplied by the manufacturer. Prior to backfilling, all nuts, bolts, and other parts of the valve joints shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Kop-Coat Bitumastic No. 300-M.

3.10 INSTALLATION OF METER VAULTS

- A. Concrete meter vaults shall be constructed in a workmanlike manner at locations and dimensions indicated on the Drawings. Precast concrete vaults shall be set on a foundation of crushed stone, 12-inches thick. The vaults shall be constructed such that the structure will not transmit dead or live loads to the piping. Care shall be taken to prevent earth and other materials from entering vault structures.
- B. Door frames and covers for meter or vault shall be cast into the top as indicated on the Drawings. In non-paved areas, the top of the vaults shall be set a minimum of 2-inches above finished grade.
- C. Install dry well door and hatch cover channel drain with 1 1/2-inch Schedule 40 PVC drain pipe as shown on the Drawings.

3.11 INSTALLATION OF TIE RODS

- A. Tie rods shall be installed in strict accordance with the manufacturer's written installation requirements. Unless otherwise indicated on the Drawings, the size and number of tie rods for a joint or installation shall be as recommended by the manufacturer's design chart for a working pressure of 150 psi.
- B. Following installation and prior to backfilling, all parts of the buried tie rod joint restraint system, including tie rods, tie bolts, nuts, washers, and other fasteners,

shall be coated with two coats, 10 mils DFT per coat, of coal tar epoxy equal to Koppers Bitumastic No. 300-M.

3.12 SEPARATION OF NON-POTABLE WATER MAINS AND POTABLE WATER MAINS

- A. Non-potable water mains shall be installed with at least a 10-foot horizontal separation from any potable water main. At crossings the installation shall provide for a minimum vertical separation distance of 18-inches between the outside of the pipes when crossing non-potable and potable water mains. This separation shall be provided where the potable water main is either below or above the non-potable water main. When the 18-inch minimum vertical separation distance cannot be maintained, the potable water main shall be encased in concrete. Concrete encasement shall be as specified above. The potable water main shall be encased for 10 feet each way of the crossing.

3.13 HYDROSTATIC PRESSURE AND LEAKAGE TESTING - See Section 15044

3.14 OBTAINING POTABLE WATER FOR TESTING AND FLUSHING

- A. The potable water supply shall be protected with an air gap or a reduced pressure principle backflow preventer approved by the Owner, if potable water is used for testing and flushing.
- B. To obtain potable water service during construction, the contractor shall be required to install a temporary water meter. The piping, fittings, backflow preventer, and appurtenances required for the temporary construction water service shall be supplied by the contractor.
- C. The contractor shall coordinate with the Owner for temporary construction water service connection, usage, and flushing.

3.15 INSTALLATION OF AIR RELEASE VALVES

- A. Piping, fittings, and the air release valves shall be installed as shown on the Drawings.
- B. The air release valve assemblies shall be installed so that they are properly supported and such that they will function properly and freely and no parts shall be strained.
- C. Air release valve testing shall be performed during the testing of pipeline which air release is attached.

3.16 MAIN CLEANING AND FLUSHING

- A. Following the hydrostatic and leakage tests, all the mains constructed under this contract shall be cleaned and flushed to remove sand, loose dirt, and other debris. Flushing velocity shall be a minimum of 2.5 fps. Flushing shall continue until clean water flows from the main. However, the Contractor shall endeavor to use the minimum amount of flushing water required to complete the work. To increase the efficiency of the cleaning and flushing operation, the Contractor shall use a pipeline pigging device of the proper size designed to clean the intended pipeline. The pigging device shall be capable of turning through a standard 90 degree MJ bend. The type of pipeline pigging device and the method of operation shall be approved by the Engineer.
- B. Upon completion of testing for the gravity drain line system, drain lines shall be flushed to remove dirt, sand, stones, and other debris which may have entered the lines during construction and settled out in the lines. Materials and debris flushed from the drain lines shall be removed from a downstream lift station and disposed of at an approved disposal area.
- C. Temporary blowoffs may be required for the purpose of flushing mains. Temporary blowoffs shall be installed as close as possible to the ends of the main being flushed. Blowoffs installed on the main shall be the same diameter as the main. Temporary blowoffs shall be removed and plugged after the main is flushed. All costs for installing and removing temporary blowoffs shall be at no additional cost to the Owner.
- D. The Owner shall be notified at least 72 hours prior to flushing mains.
- E. Blowoffs and temporary drainage piping used for flushing shall not be discharged into any gravity sewer or pumping station wetwell. The Contractor shall obtain prior approvals from the Engineer and the Owner as to the methods and locations of flushing water discharge.

3.17 FINAL DISINFECTION FOR POTABLE WATER PIPELINES

- A. Before any portion of the potable water piping systems is to be placed in service, it shall be disinfected; and its disinfection shall be demonstrated by bacteriological tests conducted in accordance with "Standard Methods for Examination of Water and Sewage" for the coli-aerogenes group, by an approved laboratory, acceptable to the Engineer and the County Health Department.
- B. All pipe, fittings, valves, and all other appurtenances installed for potable water lines shall be disinfected prior to being placed in service. Disinfection procedures shall be approved by the Engineer and shall be in conformance with ANSI/AWWA C651, latest revision.
- C. Pipe subjected to contaminating materials shall be treated in a manner approved by the Engineer. Should such treatment fail to remove contaminants from the

pipe, contaminated sections of pipe shall be replaced with new uncontaminated pipe at no additional cost to the Owner.

- D. Disinfection of a completed line shall be accomplished using the following procedure:
1. All potable water piping, fittings, valves, and appurtenances shall be disinfected with a chlorine solution with a sufficient concentration such that the initial chlorine concentration in the water line shall be a minimum of 50 mg/l available chlorine, at any point in the line.
 2. Chlorine used for the purpose of disinfection shall be high test granular calcium hypochlorite which contains approximately 65 to 70 percent available chlorine by weight. The calcium hypochlorite shall be stored in a cool, dry, and dark environment, prior to its use, to minimize deterioration. The dry calcium hypochlorite will be used to makeup a high concentration chlorine solution which will be used for disinfection. Under no circumstances will undiluted, dry calcium hypochlorite be placed in the pipeline to be disinfected.
 3. Water from the existing, in-service water line shall be made to flow at a constant, slow rate into the water line to be disinfected. Chlorine solution shall be injected or pumped at a regulated rate into the new main, at a point not more than 10 feet downstream from the beginning of the new water main. The method of tapping the water main for the chlorine injection point and the location of the tap shall be approved by the Engineer.
 4. Chlorine solution shall be circulated in the water main by opening the water control valve and systematically manipulating valves and blowoffs.
 5. Water service lines shall be disinfected in a similar manner as that for water mains, including corrective measures, by methods acceptable to the Engineer.
 6. Chlorine solution shall remain in the water lines for no less than 24 hours, but longer than 24 hours if directed by the Engineer.
 7. Extreme care shall be exercised at all times to prevent concentrated chlorine solution from entering existing water mains.
- E. After 24 hours, the free residual chlorine concentration in the water line at the pipe extremities shall be at least 10 mg/l; if not, the water lines shall be redisinfecting as described above.

- F. Final flushing of lines may proceed after 24 hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until a chlorine residual test shows that lines contain only the normal chlorine residual. Prior to flushing water with high chlorine concentrations, obtain approvals from the Engineer and the Owner as to the methods and locations of discharge.
- G. Following disinfection and thorough flushing of the water lines, as specified herein, the Contractor shall furnish all labor and materials required to obtain samples of water from established points of the water line in suitable sterilized containers obtained from the County Health Department or approved analytical laboratory. Two (2) series of successive samples shall be obtained at each established sampling points. Each test series will require two samples at each sampling point. The period between each series of samples shall be a minimum of 24 hours. Samples shall be delivered by the Contractor to the County Health Department or approved analytical laboratory for bacteriological examination. Samples shall be collected in conformance with the County Health Department standards and lab testing schedule. Prior to collecting samples, the Contractor shall notify the Engineer and the Owner who will have representatives present during sample collection.
- H. Bacteriological test results will be available approximately 48 to 72 hours after samples are submitted. If tests results are unsatisfactory, the Contractor shall immediately rechlorinate and retest the water lines and proceed with such corrective measures as are necessary to secure disinfected lines. All services shall be rechlorinated if the lines are rechlorinated. The water lines shall be redisinfected and retested, at the Contractor's expense, until approved by the Engineer, and the County Health Department.
- I. At satisfactory completion of the bacteriological test requirements, potable water lines shall be placed in service in a manner approved by the Engineer and the Owner. Contractor shall notify the Engineer and the Owner 72 hours prior to placing lines in service.

3.18 CONNECTION TO EXISTING WATER, WASTEWATER AND REUSE SYSTEMS

- A. The contractor shall coordinate making connection of the new mains to mains which are in service at the time of construction with the Owner. The contractor shall not connect to existing facilities unless the Engineer and a representative of the Owner are present. The Engineer and the Owner shall be notified at least 48 hours prior to the time connection is desired.
- B. Operation of all system valves shall be the responsibility of the Owner's personnel only. At no time shall the contractor operate any system valves. System valves shall be defined as any valve that has main pressure against either side of the valve. The contractor shall notify the Owner to request that a valve be operated, at least 48 hours prior to the time operation is required.

END OF SECTION

SECTION 15126

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: Furnish and install all pipe supports as indicated and as specified herein.
- B. Number and Location: The Drawings depict only minimum pipe support locations. Adequate pipe supports shall be supplied for all piping systems to provide a rigid overall installation and additional support for pipe ends when equipment is disconnected.

1.02 SUBMITTALS

- A. Submit manufacturer's descriptive literature for any pipe support devices and materials demonstrating compliance with this Specification and the support details shown on the Drawings.

PART 2 - PRODUCTS

2.01 PIPING SUPPORTS FOR DUCTILE IRON PIPE

- A. Furnish and install supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the Drawings or specified. Piping supports and hangers shall conform to Federal Specification WW-H-171 or shall be as specifically shown or indicated on the Drawings. Piping within structures shall be adequately supported from floors, walls, ceilings or beams. Supports from the floor shall be approved flange supports, saddle stands or suitable concrete piers as indicated or approved. Pipe saddles shall be shaped to fit the pipe with which they will be used and shall be capable of screw adjustment.
- B. Concrete piers shall conform accurately to the bottom 1/3 to 1/2 of the pipe. Piping along walls shall be supported by approved wall brackets with attached pipe rolls or saddles or by wall brackets with adjustable hanger rods. For piping supported from the ceiling, approved rod hangers proportioned for the size of pipe to be supported and of a type capable of screw adjustment after erection of the pipeline, with suitable adjustable concrete inserts or beam clamps, shall be used. The use of perforated band iron strap (plumber's strap), wire, or chain as pipe hangers will not be acceptable. If required, piping supports shall be placed so as

to provide a uniform slope in the pipe without sagging. Supports shall be located wherever necessary in the opinion of the Engineer; however, in no case shall they exceed the dimensions shown herein. Adequate supports shall especially be used adjacent to valves and fittings in pipelines. Fabricated steel or cast iron pipe supports, saddles, rolls, brackets and the like shall be as manufactured by Grinnell or an equal approved by the Engineer.

- C. All fabricated steel or cast iron pipe supports, saddles, rolls, brackets, devices, and the like shall be hot dip galvanized after fabrication and/or machining in accordance with ASTM A123. All nuts, bolts, clips and other hardware, and all hanger rods used for pipe supports, shall be Type 316 stainless steel. All nuts, bolts and threaded rods shall be in accordance with ASTM A320, Class 2. All such devices shall be painted in accordance with Section 09900, painting, after installation.

2.02 PIPE SUPPORTS FOR SMALL DIAMETER PVC PIPE

- A. Small diameter PVC piping 4-inches in diameter and smaller, shall be supported with Type 316 stainless steel pipe supports. Hardware used for pipe supports shall be Type 316 stainless steel.
- B. In some cases, to adequately support small diameter PVC or steel piping, a metal frame support structure may be required for support of the piping system. Where required, metal frame support structures shall be constructed using channels, fittings, brackets, hardware and other accessories as manufactured by B-Line Systems, Inc. of Highland, Illinois, or an equal approved by the Engineer. The materials for the frame structure shall be Type 316 stainless steel unless otherwise noted on the Drawings. Hardware used to construct the frame support structure shall be Type 316 stainless steel.
- C. Pipe supports for small diameter PVC shall be located wherever necessary in the opinion of the Engineer to adequately support the pipe; however, they shall have a maximum spacing as specified hereinafter for straight pipe runs. Adequate supports shall especially be used adjacent to valves and fittings in pipelines.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Install hangers or supports at all changes in direction at the spacing requirements stated in this specification and at the end of piping runs to minimize the stresses imposed on piping, valves, associated equipment and appurtenances.

2. Piping support systems and accessories shall be installed in accordance with the manufacturer's installation instructions.
3. Install all hangers, supports, rods, inserts, clamps, bolts and other supporting devices of sizes and spacings to prevent loads from exceeding the manufacturer's maximum recommended loading with a safety factor of 5.
4. Secure hangers to beams or approved concrete insert where possible.
5. When piping is installed on structural steel supports, provide blocking of pipe rolls to prevent lateral pipe movement.
6. Do not support piping from other pipes or from stairs and walkways.
7. Where possible, set all inserts or anchor bolts before concrete is placed.

B. Expansion and Contraction:

1. Rigidly support all piping with adequate provisions for expansion and contraction.
2. Firmly anchor horizontal runs over 50-feet in length at the midpoint of the runs to force expansion equally toward the ends.

C. Spacing:

1. Install hangers and supports at sufficiently close intervals to maintain alignment and prevent sagging.
2. The following table is based on spacing requirements for hard drawn copper tube, Class 53 DIP, Schedule 80 PVC, or Standard Weight (Schedule 40) steel pipe carrying a fluid with a Specific Gravity of 1.0 at a temperature not exceeding 120 degrees F. Support spacing for other pipe materials or for piping carrying fluids with Specific Gravities or temperatures exceeding those stated above shall be approved by the Engineer. Maximum spacing of hangers and supports shall be as follows:

<u>Nominal Pipe Diameter, (inches)</u>	<u>Support Spacing, Feet</u>			
	<u>Copper</u>	<u>Ductile Iron</u>	<u>Plastic</u>	<u>Steel</u>
1/2	4.0	N/A	3.5	4.5
3/4	4.0	N/A	4.0	5.0
1	4.0	N/A	4.5	5.5
1-1/4	6.0	N/A	5.0	6.5
1-1/2	6.0	N/A	5.0	7.5
2	6.0	N/A	5.5	8.0
2-1/2	6.0	N/A	5.5	8.0
3	6.0	N/A	6.0	8.0
4	N/A	8.0	7.0	8.0
Larger than 4	N/A	See Note	N/A	See Note

Note: Spacing shall be 10-feet maximum but may be increased depending on pipe size. Refer to AWWA standard of practice.

D. Supporting Vertical Piping:

1. Support at a maximum of 10-feet spacing.
2. Support at all points necessary to insure rigid installation with adequate provisions to allow expansion and contraction and prevent vibration.
3. Support by approved pipe collars, clamps, brackets, or wall rests.

E. Supporting PVC:

1. Support in strict accordance with the manufacturer's instructions and recommendations for the conditions of operation, temperature, and size of pipe.
2. Support in a manner which will prevent subsequent visible sagging of the pipe between supports due to plastic deformation.

F. Drain, Waste, and Vent Piping: Support by adjustable hangers.

G. Valves, Fittings, and Specialties: Independently support pipe, valves, and specialties connected to pumps and equipment.

H. Temporary Pipe Supports:

1. Lay out each section of pipeline and make connections while the pipe is held in temporary supports.

2. After the completion of connections in each section of pipeline, hold the section in place with temporary clamps.
3. Do not remove the temporary clamps until the piping is correctly installed on the permanent supports.

3.02 PAINTING

- A. All fabricated steel or cast iron pipe supports, saddles, brackets, rolls, clevises, and the like shall be painted, after installation, as specified in Sections 09900 and 09905.

END OF SECTION

SECTION 15200

PIPING, VALVES AND SPECIALTIES

PART 1 - GENERAL

- 1.01 General: All work of this Section shall be governed by all provisions of the general, special conditions of these Specifications, Sections 15000 and 15150, and the Drawings.
- 1.02 Materials listed herein are general materials to be used for refrigerant pipe systems as shown or on the Drawings. Use new materials free from defects. Specifications list all of the acceptable materials for a given service, use any one, unless otherwise specifically noted in these Specifications or on the drawings.
- 1.03 Quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society for Testing and Materials. Materials and equipment shall be manufactured in U.S.A.
- 1.04 Joints and connections shall be made permanent and water/gas tight.

PART 2 - PRODUCTS

- 2.01 Copper tubing shall be Type L, hard drawn, ASTM-B88 with wrought or cast brass solder joint fittings. Applicable uses: air conditioning condensate, domestic hot and cold water, shop compressed air, and vacuum air (for sizes 1 inch and smaller).
- 2.02 Copper Tube Type M. Condensate waste from fan coils and air handlers for lines larger than 1-inch and smaller than 3-inches.
- 2.03 Refrigerant Grade copper tubing shall be Type L, ARC hard drawn with wrought or cast copper brazed fittings. Material shall be clean and free of all oil, grease, organics and other contaminants upon completion of work. Applicable uses: argon, nitrogen, nitrous oxide, helium, hydrogen, argon-methane mix gases, compressed air for the laboratory and air conditioning refrigerant. (Air conditioning refrigerant piping is allowed to have refrigerant oil present.)
- 2.04 Threaded Steel: ASTM A-53 or A-56 EDR steel piping: applicable uses: propane, fire protection piping.
- 2.05 Stainless steel piping shall be Schedule 40, Type 316L stainless steel in accordance with ASTM A312 with NPT threaded ends. Stainless steel fittings shall be NPT threaded Type 316L Stainless steel, seamless, forged or machined from bar stock and in accordance with ASTM A403. The minimum pressure rating for fittings shall be 300 psi calculated in accordance with ANSI B31.1 with a safety factor of 4 to 1. Fittings shall be

as manufactured by the Cajon Company or approved equal. Applicable uses: laboratory acetylene gas. All piping shall be clean and free of all oil, grease, organics and other contaminants upon completion of the work.

2.06 Bronze and stainless steel valves shall be in accordance with Section 15050.

PART 3 - EXECUTION

3.01 General: The design drawings are generally diagrammatic. They do not show every bend, off-set, elbow, or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.

3.02 For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.

3.03 Hangers and Supports:

- A. Provide supports per Sections 15126. Vertical piping shall be supported at its base and no greater than every 10-feet in height.
- B. Supports shall be adequate to maintain alignment and prevent sagging and shall be made directly behind the bell or coupling, where possible, not near the center of the pipe.
- C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.
- D. Uninsulated copper pipe shall have copper or copper-clad hangers.

3.04 Jointing Pipe:

- A. All pipelines shall be correctly aligned before joints are made.
- B. Squarely cut pipe and ream properly to remove all constriction and burrs before making up the joints.
- C. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

- D. Scale prevention during brazing; keep pipe system full of inert gas to prevent scale formation.
- E. Unions and Flanges: Are not shown on drawing in every case; provide where necessary and adjacent to all equipment. Use ground joint unions on piping 1 1/2-inch and smaller. Unions in copper piping shall be brass.

3.05 Equipment Connections:

- A. Make connections between any piece of equipment and any piping system in this Section of the Specifications by means of unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance.

3.06 Air Conditioning Condensate Piping Insulation:

- A. Insulate condensate piping and waste lines from air conditioning units, and chilled water-cooled air after cooler with extruded polyethylene insulation or foam plastic insulation. Insulation shall be plenum-rated where installed in air plenums or exposed to the air stream.
- B. Miter cut insulation to fit the pipe fittings. Use approved cement to seal all joints and ends in the insulation jacket. One/half inch thickness for condensate piping and waste piping, and 3/4-inch for air after cooler.

3.07 Evacuation and Charging:

- A. When other than completely factory charged equipment and piping systems are used, they shall be evacuated and charged as follows: Charge the system with dry nitrogen and refrigerant and leak test all joints including factory piping within the units. Repair all leaks by disassembling and remaking the joint. After all leaks are corrected, evacuate the system for a period of 8-hours to an absolute pressure of 1.2" mercury. System shall hold this vacuum for two hours with no noticeable rise in pressure. Charge the system in the manner and with the type and amount of refrigerant recommended by the manufacturer and in accordance with accepted refrigeration practice.

3.08 Testing:

- A. Pressure testing all systems as follows:
 - 1. Argon: 200 PSI dry nitrogen gas
 - 2. Nitrous Oxide: 200 PSI dry nitrogen gas
 - 3. Helium: 200 PSI dry nitrogen gas

4.	Hydrogen:	200 PSI dry nitrogen gas
5.	Nitrogen:	200 PSI dry nitrogen gas
6.	Argon - Methane Mix:	200 PSI dry nitrogen gas
7.	Acetylene:	200 PSI dry nitrogen gas
8.	Propane Gas:	200 PSI dry nitrogen gas
9.	Vacuum:	200 PSI dry nitrogen gas
10.	Compressed Air:	200 PSI dry nitrogen gas
11.	Domestic Water:	150 PSI hydrostatic

- B. All systems shall be tested for a period of 24 hours without noticeable fluctuation of pressure.

3.09 Other Requirements:

- A. Arrange piping generally as shown on the Drawings and such that service access is facilitated. Keep refrigerant lines as short and direct as possible with a minimum number of joints. Provide Schedule 40 PVC sleeves through walls, sized to permit installation of full-thickness insulation; seal air tight after installation of piping and insulation.
- B. Provide a removable core filter-drier in liquid line. In-line filter-dryers are acceptable in individual circuits of less than 10 ton nominal capacity. Provide a full size valved bypass around this filter-drier. Provide shut-off valves to isolate the filter-drier while flow is through the bypass and also a shut-off valve in the bypass so that filter-drier can be put into use.
- C. Provide a refrigerant charging connection in the liquid line upstream from the filter-drier.
- D. Provide a moisture indicator/sight glass in the liquid line downstream from the filter-drier. Install in vertical line if possible and a sufficient distance downstream from any valve such that the resulting disturbance does not appear in the glass.
- E. Provide a filter-drier with isolating shut-off valves and with valved bypass only if compressor is not equipped with a suction line filter or screen.

- F. Keep piping free from traps unless otherwise indicated. Install vertical pipe plumb. Pitch horizontal piping only where slope is desirable.
- G. Provide shut-off valves at inlet and outlet to all condensers, receivers and evaporators to permit isolation for service. If possible, use angle valves to minimize pressure drop. Use angle valves in all cases at receivers. Use globe valves only when angle valves are impractical.
- H. Provide solenoid valves upright in horizontal lines only unless their design allows installation in vertical pipe.
- I. Where compressors do not have pump down control and the compressors' associated evaporator coils do not have bottom suction header connections and the evaporator coils are located above the compressors, then loop suction lines to top level of coil to prevent liquid slugging.
- J. To prevent erratic operation of thermal expansion valve, provide a suction line trap next to evaporator coil suction outlet with expansion valve bulb located between coil and trap. Provide only in suction lines which are level leaving coil outlet or which rise on leaving coil outlet. Trap not required when evaporator coil outlet suction line drops to compressor or suction header immediately after expansion valve bulb.
- K. To prevent the transmission of vibrations from compressors and vacuum pumps to pipes, equipment shall be connected to piping or tubing using flexible metallic couplings. The couplings shall be constructed of flexible Type 316 stainless steel tubing with a stainless steel braded cover. Couplings shall have NPT threaded ends.

END OF SECTION

1 SECTION 16050

2
3 ELECTRICAL - GENERAL PROVISIONS

4
5
6 PART 1 - GENERAL

7
8 RELATED DOCUMENTS:

9
10 The Drawings, "General Conditions" and Division 1 of the Contract apply to work specified in
11 Division 16.

12
13 SCOPE OF WORK:

14
15 Furnish all labor, materials, equipment and incidentals required for a complete and fully
16 operational electrical system as hereinafter specified and shown on the Contract Drawings.

17
18 The Contractor shall refer to the electrical plans, electrical diagrams, instrumentation
19 drawings and civil drawings to install the electrical equipment and appurtenances for a
20 complete and fully functional wastewater treatment plant.

21
22 The work under this division shall include furnishing and installing all equipment and
23 appurtenances shown on the drawings. The following is a list of major items to be furnished and
24 installed:

25
26 Raceways and fittings
27 Wires and cables
28 Motor Control Center
29 Miscellaneous equipment
30 Lighting system
31 Underground system
32 Grounding system
33 Service switches and disconnects
34 Diesel Engine Driven Generator
35 Automatic Transfer Switch
36 Transient Voltage Surge Suppressor
37

38 Make all field connections to process equipment furnished under other Divisions of these
39 Specifications.

40
41 Furnish and install all conduit, wire and interconnections between process instrumentation
42 primary elements, transmitters, local indicators and receivers. Mount and wire all lightning and
43 surge protection equipment at process instrumentation transmitters and receivers.

44
45 Bidders are expected to visit the job site and carefully inspect the present conditions before
46 preparing a bid.

47
48 The failure of a bidder to visit the job site shall not relieve a bidder from full responsibility for
49 all factors governing his work.
50

1 SUBMITTALS:

2
3 Shop drawings shall be submitted for the following equipment:

4
5 Pump Control Panels
6 "Solid State" Soft Starters and Motor Control Center
7 Exterior lighting fixtures and poles
8 Process control devices and panels
9 Surge protection (TVSS) devices

10
11 The manufacturers name and product designation or catalog numbers shall be submitted for the
12 following material:

13
14 Wire and electric cable
15 Conduit
16 Wiring devices
17 Boxes and fittings
18

19 Prior to submittal, all shop drawings shall be checked for accuracy and contract requirements.
20 Shop drawings shall have the date checked and shall be accompanied by a statement that the shop
21 drawings have been examined for conformity to Specifications and Drawings. This statement
22 shall also list all discrepancies with the Specifications and Drawings. Shop drawings not
23 so checked and noted shall be returned.
24

25 The entire Electrical Submittal shall be complete and delivered in one (1) package. A non-
26 complete submittal shall be returned to the Contractor without review.
27

28 The Engineer's check shall be only for conformance with the design concept of the project and
29 compliance with the Specifications and Drawings.
30

31 The Contractor has total responsibility to furnishing materials and workmanship required by the
32 Specifications and Drawings, which may not be indicated on the shop drawings.
33

34 The responsibility for all dimensions to be confirmed and correlated at the job site and for
35 coordination of this work with the work of all other trades is also included under the work of this
36 Section.
37

38 No material shall be ordered or shop work started until the Engineer's approval of shop drawings
39 has been given.
40

41 CODES, INSPECTION AND FEES:

42
43 Division 16 work shall be in accordance with the latest edition of the following codes (and/or
44 ordinances):

45
46 The National Electrical Code (NFPA 70)
47 The National Electrical Safety Code
48 The Life Safety Code (NFPA 101)
49 The Southern Standard Building Code (SBCCI)
50 Serving Utility Company

1 State and Municipal

2
3 The Contractor shall pay all fees required for permits and inspections.

4
5 TESTS AND SETTINGS:

6
7 Test all systems furnished under Division 16 and repair or replace all defective work.

8
9 “Megger” all 600 volt rated wire installed and all motors with a 1,000 volt “megger” and record
10 readings. Submit “megger” log to along with record drawings at job close-out.

11
12 Do not energize wires or motor stators that measure less than 1,000,000 ohms to ground.

13
14 Make all necessary adjustments to the systems and instruct the Owner's personnel in the Proper
15 operation of the systems.

16
17 Make all circuit breaker and protective relay settings.

18
19 CUTTING AND PATCHING:

20
21 Saw cut existing concrete and asphalt where crossings are required.

22
23 All cutting and patching shall be done in a thoroughly workmanlike manner.

24
25 INTERPRETATION OF DRAWINGS:

26
27 The Drawings are not intended to show exact locations of conduit runs.

28
29 Control wiring shall not be run in the same conduits with power wiring.

30
31 Exposed conduit shall be schedule 40 rigid aluminum unless indicated otherwise on drawings.

32
33 All connections to equipment shall be made as required, and in accordance with the approved
34 shop and setting drawings.

35
36 RECORD DRAWINGS:

37
38 As the work progresses, legibly record all field changes on a set of project contract drawings with
39 a red pen or pencil. These drawings shall be given to the Engineer at the completion of the
40 project.

41
42 COMPONENT INTERCONNECTIONS:

43
44 Components of equipment furnished under these Specifications, in general, will not be
45 furnished as integrated systems. Therefore, the Contractor shall have the task of preparing inter-
46 wiring drawings and details.

47
48 Analyze all systems components and their shop drawings.

49
50 Identify all terminals and prepare drawings and wiring tables necessary for component

interconnection. Furnish two copies of interconnection wiring diagrams and tables to the Engineer.

Contractor furnished drawings and tables shall be professionally prepared.

MANUFACTURERS SERVICES:

Provide manufacturer's services for testing and start-up of the following equipment:

Pump and Blower Controls
Diesel Generator and Transfer Switch

MATERIALS:

The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds.

Materials and equipment used shall be Underwriters Laboratories, Inc. listed.

Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors.

Electrical equipment shall be stored in dry permanent shelters.

If any apparatus has been damaged, such damage shall be repaired or replaced at no additional cost. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, or shall be replaced at no additional cost to the Owner.

GUARANTEES:

In addition to the guarantee of equipment by the manufacturer the Contractor shall also guarantee such equipment for a period of one (1) year from final acceptance by the Owner. The Contractor's one year guarantee shall be for equipment, materials, and labor.

Additional guarantee requirements may be in the General and Special Conditions of these specifications.

PART 2 - PRODUCTS

EQUIPMENT AND MATERIALS –GENERAL:

Furnish materials or equipment specified by manufacturer's named or approved equal.

Junction boxes, disconnects and panels shall be fabricated of 304 stainless steel.

EQUIPMENT AND MATERIALS STANDARDS:

The design and fabrication of electrical equipment and materials furnished under Division 16

shall comply, where applicable, with the latest edition and revisions of the following codes and standards:

- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- Institute of Electrical and Electronic Engineers (IEEE)
- National Electrical Manufacturers Association (NEMA)
- Occupational Safety and Health Administration (OSHA)
- Underwriters Laboratories (UL)
- National Fire Protection Association (NFPA)
- National Electrical Code (NEC)

EQUIPMENT RATINGS:

The horsepower and wattage of equipment shown on the drawings are estimated and maybe adjusted up or down depending on the equipment actually supplied by different manufactures.

Conduit, wire, disconnects, fuses, motor starters, and circuit breakers shall be sized to suit the horsepower and wattage of equipment actually furnished.

Conduit, wire, disconnects, fuses, and circuit breakers shall not be sized smaller than shown on the drawings.

PART 3 - EXECUTION

SUPERVISION:

The electrical work shall be supervised by a licensed journeyman or master electrician who shall be on the job site at all times while work is in progress.

WORKMEN:

Persons skilled in the trade shall perform all electrical work.

QUALITY OF WORK:

All electrical work shall be done neatly and in keeping with good practice and conventions of the trade.

CLEANING:

The interior and exterior of all equipment shall be thoroughly cleaned at the completion of installation.

TESTING:

All wiring and motors shall be "megger" tested before energizing.

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- 1 Check all three phase motors for proper rotation and current draw.
- 2
- 3
- 4 *** END OF SECTION ***

1 SECTION 16120

2
3 WIRES AND CABLES

4
5
6 PART 1 - GENERAL

7
8 SCOPE OF WORK:

9
10 Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as
11 hereinafter specified.

12
13 GENERAL REQUIREMENTS:

14
15 Wires and cables shall meet all the applicable requirements of the NEC and UL for the type of
16 insulation, jacket, and conductor specified or indicated.

17
18 All conductors shall be copper.

19
20 Wire and cable manufactured more than 12 months before delivery to the job site shall not be
21 used.

22
23 APPLICATIONS:

24
25 Wire for lighting and single power circuits shall be copper conductor with type THHN/THWN
26 insulation.

27
28 Single conductor wire used for control shall be 14AWG stranded copper with THHN/THWN
29 insulation.

30
31 Equipment grounding wires shall have Green insulation or be identified at each termination point
32 with Green plastic tape.

33
34 Neutrals shall have White insulation for 120/208 Volt systems and shall have Gray insulation for
35 277/480 Volt systems.

36
37 Large wire neutrals may be identified with White and Gray plastic tape at each termination point.

38
39 Green, White and Gray color coding shall be used for no other purpose than for identifying
40 grounds and neutrals.

41
42 Color-coding of all ungrounded circuit conductors shall be required according to the following
43 convention:

44
45 120/208 Volt, 3 phase: black, red and blue (phase A, B and C respectively)

46
47 277/480 Volt, 3 phase: brown, orange and yellow (phase A, B and C respectively)

48
49 MINIMUM SIZES:

50
51 Except for control and signal leads, no wire smaller than No. 12 AWG shall be used.

1 PART 2 - PRODUCTS

2
3 GENERAL

4
5 Wires and cables shall be of annealed, 98% conductivity, soft drawn copper unless indicated
6 otherwise on the Drawings or in these Specifications.

7
8 All conductors No. 8 AWG and larger sizes shall be stranded.

9
10 600-VOLT BUILDING WIRE:

11
12 Unless indicated otherwise on the drawings, all wiring shall be 600 volt rated.

13
14 Okonite Co., Southwire or equal shall manufacture 600 volt rated wire with Type THWN or
15 THHN insulation.

16
17 PROCESS INSTRUMENTATION AND SIGNAL CONTROL CABLE:

18
19 Provide process instrumentation and signal control cable with the number of twisted pairs shown
20 on the drawings.

21
22 Single and multiple twisted pair cable shall be rated 600 volt.

23
24 Conductors shall be Class B stranded 14 AWG bare coppers.

25
26 The insulation shall consist of 20 mils natural polyethylene and 10 mils of color-coded
27 polyvinylchloride in accordance with ECEA S-61-402.

28
29 The insulated conductors shall be twisted into pairs..

30
31 Each pair shall be color coded in accordance with ICEA S-61-402 using black and
32 white colored polyvinylchloride jackets with printed numbers for multiple pair construction.

33
34 The pair or pairs shall be cabled and shielded overall with a double-faced aluminum/synthetic
35 polymer-backed tape overlapped to provide 100 per cent coverage and a 16 AWG Class B
36 stranded coated copper drain wire.

37
38 The overall jacket shall be high-density black polyethylene in accordance with ICEA S-61-402.

39
40 Process instrumentation and signal control cable shall be manufactured by Okonite Co., Belden
41 Corp., or approved equal.

42
43
44 PART 3 - EXECUTION

45
46 WIRE AND CABLE INSTALLATION:

47
48 Cables shall be carefully handled to avoid kinks or damage.

49
50 Lubrications shall be used, if required, to facilitate pulling. Lubricants shall be U.L.
51 approved for use on the cable outer jacket.

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1 TESTS:

2

3 All 600 Volt wire insulation shall be tested with a "megger" after installation. Tests shall be
4 made at not less than 1,000 VDC.

5

6

*** END OF SECTION ***

SECTION 16216

PACKAGE GENERATOR SET

PART 1 – GENERAL

REFERENCES AND STANDARDS:

The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142
- Designed to allow for installed compliance to NFPA 70, NFPA99 and NFPA 110

WORK INCLUDED:

The work includes supplying and installing a complete integrated generator system. The system consists of a diesel generator set with related component accessories and automatic transfer switches specified under a separate section.

The CONTRACTOR shall provide fuel for all testing and a full tank of diesel fuel after the completion of all testing.

A complete system load test shall be performed after all equipment is installed.

REQUIREMENTS, CODES AND REGULATIONS:

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations.

All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment.

Manufacturer shall be ISO9001 certified.

1 SUBSTITUTION:

2
3 Proposed deviations from the specifications shall be treated as follows:

4 Requests for substitutions shall be made a minimum of ten (10) days prior to bid date.

5
6 Manufacturers catalog data shall accompany each request and authorized acceptance shall be addenda
7 only.

8
9 The power system has been designed to the specified manufacturer's electrical and physical
10 characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel
11 and exhaust components have all been sized and designed around CATERPILLAR supplied equipment.

12
13 Should any substitutions be made, the CONTRACTOR shall bear responsibility for the installation,
14 coordination and operation of the system as well as any engineering and redesign costs, which may
15 result from such substitutions.

16
17 SUBMITTALS:

18
19 Factory published specification sheet.

20
21 Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel,
22 enclosure, etc.

23
24 Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and
25 related accessories.

26
27 Weights of all equipment.

28
29 Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.

30
31 Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank,
32 remote pumps, battery charger, control panel, and remote alarm indications.

33
34 Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air
35 flows, fuel consumption, etc.

36
37 Generator electrical data including temperature and insulation data, cooling requirements, excitation
38 ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence
39 factor.

40
41 Generator resistances, reactances and time constants.

42
43 Generator locked rotor motor starting curves.

44
45 Manufacturer's and dealer's written warranty.

46
47 SYSTEM RESPONSIBILITY:

48
49 The completed engine generator set shall be supplied by the **Manufacturer's** authorized distributor

only.

REQUIREMENTS, CODES AND REGULATIONS:

The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

AUTOMATIC TRANSFER SWITCH:

The automatic transfer switch specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

WARRANTY:

Two Year Standby (ISO 8528-1: ESP) Generator Set Warranty.

The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

PARTS AND SERVICE QUALIFICATIONS:

The engine-generator supplier shall maintain 24-hour parts and service capability within 50 miles of the project site.

The supplier shall stock parts as needed to support the generator set package for this specific project.

The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

The supplier shall have been in business selling and servicing the brand of generator set proposed for a minimum of 20 years.

The dealer shall maintain qualified factory trained service personnel.

PART 2 - PRODUCTS

GENERAL REQUIREMENTS:

The generator set shall be Standby Duty rated at 175.0 ekW, 218.75 kVA, 1800 RPM, 0.8 power factor, 480 V, 3-Phase, 60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 110F (43.3C) and altitude of 500.0 feet

(152.4 m).

Standby Rating as defined by the following:

Typical Load Factor = 70% or less with variable load

Typical Hours per Year = 200 hours

Maximum Expected Usage = 500 hours/year

Typical Peak Demand = 80% of ESP rated kW with 100% of rating available for the duration of an emergency outage

MATERIALS AND PARTS:

All materials and parts comprising the unit shall be new and unused.

ENGINE:

The engine shall be diesel fueled, four (4) cycle, water-cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified kW / bHP rating. Utilization of the “Transition Program for Equipment Manufacturers” (also known as “Flex Credits”) to achieve EPA certification is not acceptable. The engine technology must not permit unfiltered exhaust gas to be introduced into the combustion cylinder.

Emissions requirements / certifications of this package: EPA TIER 3.

ENGINE GOVERNING:

The engine governor shall be a electronic Engine Control Module (ECM) with 24-volt DC Electric Actuator. The ECM shall be enclosed in an environmentally sealed, die-cast aluminum housing which isolates and protects electronic components from moisture and dirt contamination. Speed droop shall be adjustable from 0 (isochronous) to 10%, from no load to full rated load. Steady state frequency regulation shall be +/- 0.25%. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included. The ECM shall adjust fuel delivery according to exhaust smoke, altitude and cold mode limits. In the event of a DC power loss, the forward acting actuator will move to the minimum fuel position.

GENERATOR SPECIFICATIONS:

The synchronous three phase generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G3 of IEC. The excitation system shall enable the alternator to sustain 300% of rated current for ten seconds during a fault condition and shall improve the immunity of the voltage regulator to non-linear distorting loads. The Permanent Magnet (PM) excitation system shall be of brushless construction and be independent of main stator windings.

1 VOLTAGE REGULATOR:

2
3 The digital voltage regulator shall be microprocessor based with fully programmable operating and
4 protection characteristics. The regulator shall maintain generator output voltage within +/- 0.25% for any
5 constant load between no load and full load. The regulator shall be capable of sensing true RMS in three
6 phases of alternator output voltage, or operating in single phase sensing mode. The voltage regulator shall
7 include a VAR/Pf control feature as standard. The regulator shall provide an adjustable dual slope
8 regulation characteristic in order to optimize voltage and frequency response for site conditions. The
9 voltage regulator shall include standard the capability to provide generator paralleling with reactive droop
10 compensation and reactive differential compensation.

11
12 The voltage regulator shall communicate with the Generator Control Panel via a J1939 communication
13 network with generator voltage adjustments made via the controller keypad. Additionally, the controller
14 shall allow system parameter setup and monitoring, and provide fault alarm and shutdown information
15 through the controller. A PC-based user interface shall be available to allow viewing and modifying
16 operating parameters in a windows compatible environment.

17
18 CIRCUIT BREAKER:

19
20 Provide a generator mounted 100% rated circuit breaker, molded case 400 amp trip, 3 pole, NEMA
21 1/IP22. Breaker shall utilize a solid state trip unit. The breaker shall be UL/CSA Listed of IEC
22 construction and connected to engine/generator safety shutdowns. Breaker shall be housed in an
23 extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type
24 lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of
25 breaker.

26
27 GENERATOR SET CONTROL:

28
29 Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed
30 and built by the engine manufacturer. The control shall provide all operating, monitoring, and control
31 functions for the generator set.

32
33 ENVIRONMENTAL:

34
35 The generator set control shall be tested and certified to the following environmental conditions:

- 36 1. -40°C to +70°C Operating Range
- 37 2. 0-95% humidity non-condensing, 30°C to 60°C
- 38 3. IP22 protection
- 39 4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
- 40 5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
- 41 6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2,
- 42 50082-2)
- 43 7. Shock: withstand 15G

44
45 FUNCTIONAL REQUIREMENTS:

46
47 The following functionality shall be integral to the control panel.:

- 48 1. The control shall include a 33 x 132 pixel, 24mm x 95mm, positive image, transfective LCD
- 49 display with text based alarm/event descriptions.

2. Audible horn for alarm and shutdown with horn silence switch
3. Standard ISO labeling
4. Multiple language capability
5. Remote start/stop control
6. Local run/off/auto control integral to system microprocessor
7. Cool-down timer
8. Lamp test
9. Push button emergency stop button

DIGITAL MONITORING CAPABILITY:

The controls shall provide the following digital readouts for the engine and generator.
All readings shall be indicated in either metric or English units.

Engine

1. Engine oil pressure
2. Engine coolant temperature
3. Engine RPM
4. Battery volts

Generator

1. Generator AC volts (Line to Line, Line to Neutral and Average)
2. Generator AC current (Per phase and Average)
3. Generator AC Frequency

ALARMS AND SHUTDOWNS:

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions:

1. Low oil pressure alarm/shutdown
2. High coolant temperature alarm/shutdown
3. Loss of coolant shutdown
4. Over-speed shutdown
5. Over-crank shutdown
6. Emergency stop depressed shutdown
7. Low coolant temperature alarm

All alarms and shutdowns are accompanied by an engine hour stamp that are stored by the control panel for first and last occurrence.

INPUTS AND OUTPUTS:

The control shall include the ability to accept six (6) digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

The control shall include the ability to operate six (6) programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC.

1 MAINTENANCE:

2
3 All engine, voltage regulator, control panel and accessory units shall be accessible through a single
4 electronic service tool.

5
6 The following maintenance functionality shall be integral to the generator set control:

- 7 1. Engine running hours display
8 2. 20 events are stored in control panel memory
9

10 COOLING SYSTEM:

11
12 The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all
13 accessories. The cooling system shall be sized to operate at full load conditions and 110 F* ambient air
14 entering the enclosure. The generator set supplier is responsible for providing a properly sized cooling
15 system based on the enclosure static pressure restriction.
16

17 FUEL SYSTEM:

18
19 The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the
20 engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line
21 to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized
22 piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi.
23

24 WALK-AROUND STYLE FUEL SUB-BASE FUEL TANK:

25
26 Provide a walk-around style double wall sub-base tank constructed to meet all local codes and
27 requirements. The sub-base tank walkway around the generator housing shall be a minimum of 18 inches
28 wide. The top of the sub-base tank walkway shall be no more than 20 inches above grade allowing for an
29 easy step up onto the walkway for maintenance. fuel tank shall have 72-hours of run time capacity at 75%
30 of full load. It shall be contained in a rupture basin with 110% capacity. The tank shall meet UL142
31 standards. A locking fill cap, fuel fill spill containment means, a mechanical reading fuel level gauge, low
32 fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.
33

34 The tank and appurtenances shall be Florida DEP approved.
35

36 STARTING SYSTEM:

37
38 A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be
39 as recommended by the engine manufacturer.
40

41 JACKET WATER HEATER:

42
43 Jacket water heater shall be provided and shall be sized to insure that genset will start within the
44 specified time period and ambient conditions. Jacket water heater shall operate on 240 VAC.
45

46 BATTERIES:

47
48 Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided.
49 Battery voltage shall be compatible with the starting system.

1 BATTERY CHARGER:

2
3 A current limiting battery charger shall be furnished to automatically recharge batteries. The charger
4 shall be dual charge rate with automatic switching to the boost rate when required. The battery charger
5 shall be mounted inside the generator set enclosure.

6
7 Battery charger shall operate on 120 VAC.

8
9 ENCLOSURE:

10
11 The complete diesel engine generator set, including generator control panel, engine starting batteries and
12 battery charger , shall be enclosed in a factory assembled, weather protective enclosure mounted on the fuel
13 tank base.

14
15 The enclosure shall be fabricated using aluminum.

16
17 The enclosure and tank shall be painted with electrostatically applied powder coated baked on polyester
18 paint.

19
20 Fasteners shall be stainless steel.

21
22 Access doors shall be hinged and can be lifted off after opening 90 degrees. Intake openings shall be
23 screened to prevent the entrance of rodents or pests.

24
25 Lube oil and coolant drains shall be extended to the exterior of the enclosure and terminated with drain
26 valves.

27
28 Cooling fan and charging alternator shall be fully guarded to prevent injury.

29
30
31 PART 3 – EXECUTION

32
33 INSTALLATION:

34
35 Install equipment in accordance with manufacturer's recommendations, the project drawings and
36 specifications, and all applicable codes.

37
38 START-UP AND TESTING:

39
40 Coordinate all start-up and testing activities with the Engineer and Owner.

41
42 After installation is complete and normal power is available, the manufacturer's local dealer shall
43 perform the following:

44
45 1. Perform a 4-hour load bank test at a 0.8 PF at full nameplate rating.

46
47 2. Load-bank, cables and other equipment required for this test to be supplied by the genset
48 supplier.

OPERATION AND MAINTENANCE MANUALS:

Provide two (2) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

TRAINING:

Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

END OF SECTION

SECTION 16413

ENCLOSED AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL

SCOPE:

It is the intent of this specification to secure a transfer switch that has been prototype tested, factory built, production tested and site tested. A transfer switch with the number of poles, voltage and current ratings shown on the plans and specified herein shall be provided.

REFERENCES AND STANDARDS:

The automatic transfer switch shall conform to the requirements of:

- UL 1008: Underwriters Laboratories standard for automatic transfer switches
- CSA: C22.2 No. 178 certified
- IEC: 947-6-1 certified at 480 VAC
- NFPA 70: National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
- NFPA 99: Essential electrical systems for health care facilities
- NFPA 101: Life safety code
- NFPA 110: Standard for emergency and standby power systems
- IEEE 241: I.E.E.E. recommended practice for electrical power systems in commercial buildings
- IEEE 446: I.E.E.E. recommended practice for emergency and standby power systems
- NEMA ICS10: AC automatic transfer switch equipment
- UL 50/508: Enclosures
- ICS 6: Enclosures
- ANSI C33.76: Enclosures
- NEMA 250: Enclosures
- IEEE 472: (ANSI C37.90A): Ringing wave immunity
- EN55022 (CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
- EN61000-4-2: (Level 4): ESD immunity test Class B:
- EN61000-4-3: (ENV50140): Radiated RF, electromagnetic field immunity
- EN61000-4-4: Electrical fast transient/burst immunity test
- EN61000-4-5: IEEE C62.41: Surge immunity test (1.2 x 50µs, 5 & 8 kV)
- EN61000-4-6: (ENV50141): Conducted immunity test
- EN61000-4-11: Voltage dips and interruption immunity

PART 2 – PRODUCTS

APPROVED MANUFACTURERS:

The automatic transfer switch shall be ASCO or RussElectric. Alternate manufactures shall submit a request two weeks prior to bid and include a written list of deviations from this specification to be

1 considered for approval.

2
3 PERFORMANCE AND CONSTRUCTION:

4
5 The automatic transfer switch shall be of double throw construction operated by a reliable solenoid or
6 motor driven mechanism. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or
7 less.

8
9 The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or
10 disarrangement of any part shall not permit a neutral position.

11
12 The contact structure shall consist of a main current carrying contact, which is a silver alloy with a
13 minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing
14 contacts.

15
16 The transfer switch manufacturer shall submit test data, showing it can withstand fault currents of the
17 magnitude and the duration necessary to maintain the system integrity.

18
19 A dielectric test at the conclusion of the withstand and closing tests shall be performed.

20
21 The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50
22 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts,
23 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow
24 between the two isolated sources during switching.

25
26 All relays shall be continuous duty industrial type with wiping contacts. Coils, relays, timers and
27 accessories shall be readily front accessible. The control panel and power section shall be interconnected
28 with a harness and keyed disconnect plugs for maintenance.

29
30 Main and arcing contacts shall be visible without major disassembly to facilitate inspection and
31 maintenance.

32
33 A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator
34 disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual
35 operation.

36
37 Switches composed of molded case breakers, lighting contactors or components thereof will not be
38 acceptable.

39
40 The current rating shall be a continuous rating when the switch is installed in an enclosure, and shall
41 conform to NEMA temperature rise standards.

42
43 Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and
44 endurance tests to confirm the ability of the units to carry their rated currents within the allowable
45 temperature limits.

46
47 The switch shall be mounted in a NEMA 1 enclosure.
48
49

1 FACTORY TESTS:

2
3 The transfer switch manufacturer shall perform a complete functional test on the switch, controller and
4 accessories prior to shipping from the factory. A certified test report shall be available upon request.

5
6 CONTROL:

7
8 The control panel shall be opto-isolated from electrical noise and provided with the following inherent
9 control functions and capabilities:

10
11 Easy-to-view 4 x 20 LCD display with long lasting LED indicators.

12 Control panel shall display voltage and frequency of both sources.

13 The user shall be able to view the last 16 recorded events.

14 Capability for external communication and network interface.

15 Adjustments to all settings shall be made from the front of the panel without opening the door.

16
17 The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall
18 perform the operational and display functions of the transfer switch. The display functions of the control
19 panel shall include ATS position, source availability, sequence indication and diagnostics.

20
21 All programmable and control functions shall be pass code protected and accessible through the keypad.

22
23 The control panel shall be provided with a simple user interface for transfer switch monitoring, control and
24 field changeable functions and settings.

25
26 Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source
27 failure.

28
29 The controller shall provide digital timer adjustments with 1-second resolution. Voltage and Frequency
30 shall be adjustable to 1% resolution to facilitate accurate transfer.

31
32 To ensure reliable and consistent user operation the controls must be equipped with nonvolatile memory
33 and allow automatic daylight savings time adjustment.

34
35 SEQUENCE OF OPERATION:

36
37 The ATS shall incorporate adjustable three phase under voltage sensing on the normal source.

38
39 When the voltage of any phase of the normal source is reduced to 80% (adjustable) of nominal voltage, for
40 a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.

41
42 The ATS shall incorporate adjustable under voltage and under frequency sensing on the emergency source.

43
44 When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within
45 95% of the rated value, the load shall be transferred to the emergency source after a programmable time
46 delay.

47
48 When the normal source has been restored to not less than 90% of rated voltage on all phases, the load
49 shall be retransferred to the normal source after a time delay of 0 to 60 minutes (programmable). The

generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.

If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.

FEATURES:

Provide the following features or an equivalent means of performing the same function:

Adjustable time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.

Adjustable time delay on retransfer to normal source, programmable 0-60 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.

A time delay on transfer to emergency, programmable 0-5 minutes, factory set at 1 second.

An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and be programmed to anticipate the zero crossing point to minimize switching transients.

An exerciser timer with momentary test pushbutton shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a daily, weekly or monthly basis. The exerciser shall contain a battery for memory retention during an outage.

Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.

The controller shall accept a remote peak shave or test input to signal the transfer switch to the emergency position.

A set of customer contacts shall be provided to indicate both emergency and normal source position.

Programmable Clock Exerciser (CDP) – This will replace the timer exerciser and allow for a 365 day cycle.

Voltage Imbalance Monitor (VI) - Three Phase sensing shall detect an imbalance and initiate a transfer to the alternate source. Adjustable 5-20% of nominal with a time delay of 10-30 seconds for nuisance conditions.

PART 3 – EXECUTION

GENERAL:

The transfer switch shall be installed as shown on the plans, in accordance with the manufacture's

1 recommendations and all applicable codes.

2
3 SERVICE:

4
5 The manufacturer shall maintain a national service organization that is factory trained and certified for
6 transfer switch equipment. In addition, the service organization shall be available 24 hours per day, 365
7 days per year.

8
9 WARRANTY:

10
11 The automatic transfer switch shall be warranted against defective workmanship for a period of two years,
12 including both parts and labor.

13
14 ***END OF SECTION***

1 SECTION 16450

2
3 GROUNDING

4
5
6 PART 1 - GENERAL

7
8 SCOPE OF WORK:

9
10 The work required under this section of the specifications consists of the installation of the complete grounding
11 system for the project. Provide all materials required for the grounding system under this section of the
12 specifications.

13
14 RELATED WORK:

15
16 Coordinate installation of grounding system with all work required under Division 16.

17
18 APPLICATION:

19
20 Equipment grounding conductors shall be used to establish grounding of the entire system.

21
22 Equipment grounding shall not be by metallic raceway alone.

23
24 Table 250-94 of the NEC shall be used to size all grounding electrode conductors.

25
26 Table 250-95 of the NEC shall be used to size equipment grounding conductors.

27
28
29 PART 2 - PRODUCTS

30
31 GROUND RODS:

32
33 Ground rods shall be 3/4" X 10', regular or sectional as required, unless indicated otherwise.

34
35 Construction shall be a solid steel core with a heavy uniform covering of electrolytic copper.

36
37 Threads, on sectional rods, shall be rolled (not cut) into the composite metal after the copper covering has been
38 applied.

39
40 Copper covering shall be work hardened by drawing rods.

41
42 Sectional rod couplings shall be of a corrosion resistant alloy.

43
44 GROUNDING ELECTRODE CONDUCTOR CONNECTIONS:

45
46 Conductor connections to ground rods shall be by UL approved corrosion exothermic weld.

47
48 All grounding connections shall be by UL approved means.

EQUIPMENT GROUNDING CONDUCTORS:

Equipment grounding conductors shall be green with THWN or THHN insulation (See Section 16120 - Wires and Cables).

PART 3 - EXECUTION

INSTALLATION:

Ground all non-current carrying metal parts of the electrical system to provide a low impedance path for ground fault current.

The neutral conductor(s) of the incoming electrical service shall be grounded to the ground rod system, metal cold water piping system, and structural steel using Table 250-94 of the NEC for conductor sizing. Grounding conductors shall be run in rigid non-metallic conduit.

Ground the neutral of all dry type transformers to effectively grounded building steel or metal cold water piping system as near as practicable using Table 250-94 of the NEC to size conductor.

Grounding conductors shall be attached to equipment with a bolt or sheet metal screw used for no other purpose. Use crimp on spade lugs for stranded conductor.

*** END OF SECTION ***

1 SECTION 16500

2
3 LIGHTING SYSTEM

4
5
6 PART 1 – GENERAL

7
8 SCOPE OF WORK:

9
10 Fixtures shall be furnished and installed as shown on the plans and as herein specified.

11
12 PART 2 - PRODUCTS

13
14 LIGHTING FIXTURES:

15
16 Lighting fixture types shall be as shown on the on the Drawings. The catalog numbers listed
17 are given as a guide to the design and quality of fixture desired.

18
19 Equivalent designs and equal quality fixtures of other manufacturers may be submitted for
20 acceptance.

21
22 LAMPS:

23
24 Lamps shall be of one manufacturer and shall be manufactured by Sylvania Electric Products,
25 Inc., General Electric Company, or North American Philips.

26
27 BALLASTS:

28
29 High Pressure Sodium ballasts shall be of the high power factor (HPF), constant wattage
30 autotransformer type and of the correct size and voltage for the fixture it is to serve as called for
31 on the Drawings.

32
33 Advance, Sylvania Electric Products, Inc., Universal, or General Electric Company shall
34 manufacture all ballasts.

35
36 PART 3 - EXECUTION

37
38 INSTALLATION:

39
40 Each fixture shall be a completely finished unit with
41 all components, mounting and/or hanging devices necessary, for the proper installation of the
42 particular fixture in its designated location and shall be completely wired ready for connection to
43 the branch circuit wires.

44
45 CLEANING UP:

46
47 All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the
48 Engineer.

49 *** END OF SECTION ***

1 SECTION 16920

2
3
4 LOW VOLTAGE MOTOR CONTROL CENTER

5
6
7 PART 1 - GENERAL

8
9 RELATED DOCUMENTS:

10
11 The Drawings, "General Conditions" and Division 1 of the Contract apply to work specified in
12 Division 16.
13

14 DESCRIPTION:

15
16 This section includes requirements for a motor control center (MCC) and all required control
17 devices as shown on the drawing and specified to be part of the MCC equipment. The MCC shall
18 be 480 V, 3-Phase, 3-Wire, 60 Hz rated.
19

20 SUBMITTALS:

21 Submit with the delivery of the MCC an Installation and Maintenance Manual and one (1) copy
22 of the manufacturer's drawings per shipping block.
23

24 REGULATORY REQUIREMENTS:

25
26 The MCC must conform to Underwriters Laboratory (UL) 845, current revision, CSA, EEMAC,
27 NEMA ICS-2, the latest version of the National Electrical Code, and the Canadian Electrical
28 Code. The MCC must be manufactured in an ISO 9001 certified facility.
29

30 PACKING/SHIPPING:

31
32 The MCC shall be separated into shipping blocks no more than three vertical sections each.
33 Shipping blocks shall be shipped on their sides to permit easier handling at the jobsite. Each
34 shipping block shall include a removable lifting angle, which will allow an easy means of
35 attaching an overhead crane or other suitable lifting equipment.
36

37 STORAGE:

38 If the MCC cannot be placed into service reasonably soon after its receipt, store it in a clean, dry
39 and ventilated building free from temperature extremes. Acceptable storage temperatures are
40 from 0° C (32° F) to 40° C (104° F).
41

1 WARRANTY:

2 See Section 16050.

5 PART 2 - PRODUCTS

7 MANUFACTURERS:

9 Shall be Square D brand or Engineer approved equal.

11 MATERIALS:

13 Steel material shall comply with UL 845 and CSA requirements.

15 Each MCC shall consist of one or more vertical sections of heavy gauge steel bolted together to
16 form a rigid, free-standing assembly. A removable 7 gauge structural steel lifting angle shall be
17 mounted full width of the MCC shipping block at the top. Removable 7 gauge bottom channel
18 sills shall be mounted underneath front and rear of the vertical sections extending the full width of
19 the shipping block. Vertical sections made of welded side-frame assembly formed from a
20 minimum of 12 gauge steel. Internal reinforcement structural parts shall be of 12 and 14 gauge
21 steel to provide a strong, rigid assembly. The entire assembly shall be constructed and packaged
22 to withstand normal stresses included in transit and during installation.

24 MCC FINISH:

26 All steel parts shall be provided with UL and CSA listed acrylic/alkyd baked enamel paint finish,
27 except plated parts used for ground connections. All painted parts shall undergo a multi-stage
28 treatment process, followed by the finishing paint coat.

30 Pre-treatment shall include:

31 The use of hot alkaline cleaner to remove grease and oil.

32 Iron phosphate treatment to improve adhesion and corrosion resistance.

34 The paint shall be applied using an electro-deposition process to ensure a uniform paint coat with
35 high adhesion.

37 The standard paint finish shall be tested to UL 50 per ASTM B117 (5% ASTM Salt Spray) with
38 no greater than 0.125 in (3 mm) loss of paint from a scribed line.

40 Paint color shall be #49 medium light gray per ANSI standard Z55.1-967 (60-70 gloss) on all
41 surfaces unless specified otherwise. Control station plates and escutcheon plates shall be a
42 contrasting gray.

1 STRUCTURES:

2
3 Structures shall be totally enclosed, dead-front, free-standing assemblies. Structures shall be
4 capable of being bolted together to form a single assembly.

5
6 The overall height of the MCC shall not exceed 90 in (2286 mm) (not including base channel or
7 lifting angle). Base channels, of 1.5 in (38 mm) in height, and lifting angles, of 3 in (76 mm) in
8 height, shall be removable. The total width of one section shall be 20 in (508 mm).

9
10 Structure shall be NEMA/EEMAC type 1 (general purpose).

11 Each 20 in wide standard section shall have all the necessary hardware and bussing for modular
12 plug-in units to be added and moved around. All unused space shall be covered by hinged blank
13 doors and equipped to accept future units. Vertical bus openings shall be covered by manual bus
14 shutters.

15
16 Each section shall include a top plate (single piece or two-piece). NEMA/EEMAC type 12 shall
17 also include a bottom plate. Top and bottom plates shall be removable for ease in cutting conduit
18 entry openings.

19
20 WIREWAYS:

21
22 Structures shall contain a minimum 12 in (305 mm) high horizontal wireway at the top of each
23 section and a minimum 6 in (152 mm) high horizontal wireway at the bottom of each section.
24 These wireways shall run the full length of MCC to allow room for power and control cables to
25 connect between units in different sections.

26
27 A full-depth vertical wireway shall be provided in each MCC section that accepts modular plug-
28 in units. The vertical wireway shall connect with both the top and bottom horizontal wireway.
29 The vertical wireway shall be 4 in (102 mm) wide minimum with a separate hinged door. There
30 should be a minimum of 60 in² (387 cm²) of cabling space available for 15-inch-deep sections
31 and 80 in² (516 cm²) of cabling space available for 20-inch-deep sections. Access to the
32 wireways shall not require opening control unit doors. Structures that house a single, full section
33 control unit are not required to have vertical wireways. Those control units must open directly
34 into the MCC horizontal wireways.

35
36 BARRIERS:

37
38 All power bussing and splice connections shall be isolated from the unit compartments and the
39 wireways. The horizontal bus shall be mounted onto a glass filled polyester support assembly
40 that braces the bus against the forces generated during a short circuit. The horizontal bus shall be
41 isolated from the top horizontal wireway by a two-piece rigid non-conductive barrier. The barrier
42 design shall allow qualified personnel to slide the barriers both left and right, to allow access to
43 the bus and connections for maintenance without having to remove the barrier. Barrier sliding
44 shall occur via an upper and lower track system.

1 The vertical bus shall be housed in a molded glass-filled polyester support that provides bus
2 insulation and braces the bus against the forces generated during a short circuit. These supports
3 shall have openings every 3 in (75 mm) for unit stab-on connections. Each opening shall be
4 provided with a manual shutter to close off the stab opening. These shutters shall be attached to
5 the structure so that when they are removed (to allow a stab connection) they are retained in the
6 structure and are readily accessible for use should a plug-in unit be removed from the MCC.

7
8 BUSSING:

9
10 All bussing and connectors shall be tin-plated copper.

11
12 The main horizontal bus shall be rated at 600A continuous and shall extend the full length of the
13 MCC.

14
15 Bus ratings shall be based on 65° C maximum temperature rise in a 40° C ambient.

16
17 Provisions shall be provided for splicing additional sections onto either end of the MCC.

18
19 The horizontal bus splice bars shall be pre-assembled into a captive bus stack. This bus stack is
20 installed into the end of the MCC power bus to allow the installation of additional sections. The
21 main bus splice shall utilize four bolts, two on each side of the bus split, for each phase.
22 Additional bolts must not be required when splicing higher amperage bus. The splice bolts shall
23 secure to self clenching nuts installed in the bus assembly. It shall be possible to maintain any
24 bus connection with a single tool.

25
26 Each section that accepts plug-in units shall be provided with a vertical bus for distributing power
27 from the main bus to the individual plug-in starter units. This bus shall be of copper and plating
28 as the main bus, and shall be rated at 300A continuous. The vertical bus shall be connected
29 directly to the horizontal bus stack without the use of risers or other intervening connectors. It
30 shall be possible to maintain the vertical to horizontal bus connection with a single tool. "Nut and
31 bolt" bus connections to the power bus shall not be permitted. When a back-to-back unit
32 arrangement is utilized, separate vertical bus shall be provided for both the front and rear units.

33
34 A tin-plated copper ground bus shall be provided that runs the entire length of the MCC. The
35 ground bus shall be 0.25 in (6.0 mm) x 1.0 in (25 mm) and be rated for 300 amps. A compression
36 lug shall be provided in the MCC for a 4/0-250 kcmil ground cable. The ground bus shall be
37 provided with (6) 0.38 in (10 mm) holes for each vertical section to accept customer-supplied
38 ground lugs for any loads requiring a ground conductor.

39
40 Each vertical section shall have a copper vertical ground bus that is connected to the horizontal
41 ground bus. This vertical ground bus shall be installed so that the plug-in units engage the ground
42 bus prior to engagement of the power stabs and shall disengage only after the power stabs are
43 disconnected upon removal of the plug-in unit.

The system shall be rated for an available short circuit capacity of 22,000 rms amperes.

TYPICAL UNIT CONSTRUCTION:

Units with circuit breaker disconnects through 400 A frame, and fusible switch disconnects through 400 A, shall connect to the vertical bus through a spring reinforced stab-on connector. Units with larger disconnects shall be connected directly to the main horizontal bus with appropriately sized cable or riser bus.

All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material to prevent accidental contact with those parts.

Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All plug-on units shall use a twin-handle camming lever located at the top of the bucket to rack in and out the plug-on unit. The cam lever shall work in conjunction with the hanger brackets to ensure positive stab alignment.

A lever handle operator must be provided on each disconnect. With the unit stabs engaged onto the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door. Clear indication of disconnect status shall be provided, by adhering to the following operator handle positions:

Handle "On" position must be up or to the left and within 45 degrees of being parallel to the face of the equipment.

Handle "Off" position must be down or to the right and within 45 degrees of being parallel to the face of the equipment.

The minimum separation between the "On" and "Off" positions shall be 90 degrees.

On Circuit Breaker disconnects, the handle "Tripped" position must be perpendicular to the face of the equipment +/- 30 degrees. Minimum separation between "On" and "Tripped" shall be 30 degrees. Minimum separation between "Tripped" and "Off" shall be 45 degrees.

A mechanical interlock shall prevent the operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent the operator from placing the disconnect in the ON position while the unit door is open. It shall be possible for authorized personnel to defeat these interlocks.

A non-defeatable interlock shall be provided to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position.

1 The plug-in unit shall have a grounded stab-on connector which engages the vertical ground bus
2 prior to, and releases after, the power bus stab-on connectors.

3
4 Provisions shall be provided for locking all disconnects in the OFF position with up to three
5 padlocks.

6
7 Handle mechanisms shall be located on the left side to encourage operators to stand to the left of
8 the unit being switched.

9
10 Unit construction shall combine with the vertical wireway isolation barrier to provide a fully
11 compartmentalized design.

12
13 COMPONENTS FOR TYPICAL UNITS:

14 All combination starters shall utilize a unit disconnect as specified in the previous article.
15 Magnetic starters shall be furnished in all combination starter units. All full voltage starters shall
16 utilize NEMA/EEMAC rated contactors. Starters shall be provided with a three-pole, external
17 manual reset, overload relay for ambient compensated bimetallic thermal overload units.

18
19 Provided a control circuit transformers for each compartment. Control circuit transformer shall
20 include two primary protection fuses and one secondary fuse (in the non-ground secondary
21 conductor). The transformer shall be sized to accommodate the contactor(s) and all connected
22 control circuit loads. The transformer rating shall be fully visible from the front when the unit
23 door is opened.

24
25 Auxiliary control circuit interlocks shall be provided where indicated. Auxiliary interlocks shall
26 be field convertible to normally open or normally closed operation.

27
28 NEMA/EEMAC Size 1-4 starters shall be mounted directly adjacent to the wireway so that power
29 wiring (motor leads) shall connect directly to the starter terminals without the use of interposing
30 terminals. Larger starters shall be arranged so that power wiring may exit through the bottom of
31 the starter cubical without entering the vertical wireway.

32
33 Provide Type B wiring with all starter units furnished with control terminal blocks.

34 Terminal blocks shall be the pull-apart type 600 volt and rated at 25 amps. All current carrying
35 parts shall be tin plated. Terminals shall be accessible from inside the unit when the unit door is
36 opened. Terminal blocks shall be DIN rail mounted with the stationary portion of the block
37 secured to the unit bottom plate. The stationary portion shall be used for factory connections, and
38 shall remain attached to the unit when removed. The terminals used for field connections shall
39 face forward so they can be wired without removing the unit or any of its components.

40
41 Each compartment shall have an engraved phenolic nameplates with a gray background and white
42 letters. Total outside dimensions will be a minimum of 1.5 in (38 mm) H x 6.25 in (159 mm) W
43 total outside dimensions.

Each combination starter unit shall be provided with a hinged/removable control station plate, which can accommodate up to five 22 mm pilot devices or three 30 mm pilot devices.

SIX INCH UNIT CONSTRUCTION:

Units with circuit breaker disconnects through 100 A frame, and fusible switch disconnects through 100 A, shall connect to the vertical bus through a spring-reinforced stab-on connector. Stabs on all plug-on units shall be cable connected to the unit disconnect. Six inch fusible units shall accept Class J fuses only.

All conducting parts on the line side of the unit disconnect shall be shrouded by a suitable insulating material.

Unit mounting shelves shall include hanger brackets to support the unit weight during installation and removal. All six inch plug-on units shall be installable without the assistance of a camming device so as to allow maximum accessibility with the unit installed.

A lever handle operator must be provided on each disconnect. With the unit stabs engaged into the vertical phase bus and the unit door closed, the handle mechanism shall allow complete ON/OFF control of the unit disconnect with clear indication of the disconnects status. All circuit breaker operators shall include a separate TRIPPED position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.

A mechanical interlock shall prevent an operator from opening the unit door when the disconnect is in the ON position. Another mechanical interlock shall prevent an operator from placing the disconnect in the ON position while the door is open. It shall be possible for authorized personnel to defeat these interlocks.

A non-defeatable interlock shall be provided between the handle operator and the structure to prevent installing or removing a plug-on unit unless the disconnect is in the OFF position. The plug-on unit shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.

Provisions shall be made for locking all disconnects in the OFF position with up to three padlocks.

Handle mechanisms shall be located on the bottom left side of the unit and operate horizontally to encourage operators to stand to the left of the unit being switched.

Unit construction shall combine with the vertical wireway isolation barrier to provide a fully-compartmentalized design.

Up to a maximum of twelve six inch units can be installed per vertical section without placement restrictions.

1 COMPONENTS FOR SIX INCH UNITS:

2 All six inch combination starters shall use a unit disconnect as specified in the previous article.

3
4 All starters shall use NEMA/EEMAC-rated contactors. Starter units shall be provided with a 3-
5 pole, external manual reset, overload relay for ambient compensated bi-metal motor overload
6 protection.

7
8 Auxiliary control circuit interlocks shall be provided. Auxiliary interlocks shall be field
9 convertible to normally open or normally closed operation.

10
11 NEMA/EEMAC Size 1 starters shall be mounted directly adjacent to the wireway so that power
12 wiring (motor leads) will connect directly to the starter terminals.

13
14 UNITS EQUIPPED WITH SOFT STARTERS:

15
16 Provide Combination Soft Starters where indicated on the drawings.

17
18 Soft Starters shall be Square D Altistart 48 units or Engineer approved equal.

19
20 Provide an EIC rated shorting contactor which shall close when motor is up to speed and open
21 before motor is ramped down in speed by the soft starter.

22 Provide a shunt trip over current circuit breaker which shall trip on a fault condition sensed by the
23 Altistart 48 soft starter. Circuit breaker shall also double as a disconnecting means.

24
25 QUALITY CONTROL:

26
27 The entire MCC shall go through a quality inspection before shipment. This inspection will
28 include:

29 The Structure.

30 The bussing.

31 The general wiring.

32 Checking power circuit phasing.

33 Control circuit wiring.

34 Instrument transformers.

35 Meters.

36 Devices electrical operation.

37 AC dielectric tests on all power circuits.

1 Markings/Labels, to include:

2 instructional type.

3 Underwriters Laboratory (UL)/Canadian Standards Association (CSA).

4 inspector's stamps.

5
6 The manufacturer shall use integral quality control checks throughout the manufacturing process
7 to ensure that the MCC meets operating specifications.

8
9
10 PART 3 - EXECUTION

11 LOCATION:

12
13
14 The area chosen shall be well ventilated and totally free from humidity, dust and dirt.

15
16 The temperature of the area shall be no less than 0° C (32° F) and no greater than 40° C (104° F).

17
18 Protection must be provided to prevent moisture entering the enclosure.

19
20 Motor control centers shall be located in an area with a minimum of 3 ft (915 mm) of free space
21 in front of front-of-board construction. This free space will give adequate room to remove and
22 install units. A minimum of 0.5 in (13 mm) space should be provided between the back of front-
23 of-board MCCs and a wall, 6 in (152 mm) required for damp locations.

24
25 The MCCs shall be assembled in the factory on a smooth level surface so that all sections are
26 properly aligned. A similar smooth and level surface shall be provided for installation. An
27 uneven foundation will cause misalignment of shipping blocks, units, and doors.

28
29 *** END OF SECTION ***

SOUTH COLUMBIA COUNTY REGIONAL
WASTEWATER TREATMENT PLANT

APPENDIX C

FDEP Permit

SOUTH COLUMBIA COUNTY REGIONAL
WASTEWATER TREATMENT PLANT

APPENDIX B

Geotechnical Exploration
and
Data Evaluation

SOUTH COLUMBIA COUNTY REGIONAL
WASTEWATER TREATMENT PLANT

APPENDIX A

NPDES Generic Permit Instructions

GEOTECHNICAL EXPLORATION, DATA EVALUATION, AND ENGINEERING CONSULTATION SERVICES REPORT

Proposed Ellisville Storage Tank off Wire Road Ellisville, Columbia County, Florida

ASC Project No. 08G2006
ASC Document No. 080306L
29 October 2008

prepared for:
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29 October 2008

**Subject: Geotechnical Exploration, Data Evaluation,
and Engineering Consultation Services Report
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida**

ASC Project No. 08G2006
ASC Document No. 080306L

Dear Mr. Neihaus:

ASC geosciences, inc. is pleased to submit two (2) originals plus an electronic PDF version on CD of the *Geotechnical Exploration, Data Evaluation, and Engineering Consultation Services Report* to Eutaw Utilities, Inc., for the project referenced above.

It has been a pleasure to work on this project. We look forward to being involved during the construction phase of the project as well. Please contact us should you have any questions or require additional information.

Sincerely,

ASC geosciences, inc.

Prashanth Vaddu, E.I.
Project Engineer



D.S. "Sax" Saxena, P.E.
Senior Consulting Principal/Chief Consultant
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Mr. Mark Neihaus
Eutaw Utilities, Inc.
**Geotechnical Exploration, Data Evaluation,
and Engineering Consultation Services Report**
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida
ASC Project No. 08G2006
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ASC geosciences, inc.
29 October 2008

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Mr. Mark Neihaus
Eutaw Utilities, Inc.

ASC geosciences, inc.
29 October 2008

**Geotechnical Exploration, Data Evaluation,
and Engineering Consultation Services Report**
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida
ASC Project No. 08G2006
ASC Document No. 080306L

Figure 5 Location of Documented and Other Reported Sinkholes in Columbia County,
Florida within 1/2 mile of Project Site

Figure 6 Subsurface Soil Stratigraphy

APPENDIX A *Important Information About Your Geotechnical Engineering Report* by ASFE

1.0 INTRODUCTION

1.1 Terms of Reference

ASC geosciences, inc. was retained by Eutaw Utilities, Inc., (Client) to provide certain Geotechnical Exploration, Data Evaluation, and Engineering consultation services for the proposed Ellisville Storage Tank located off Wire Road, in Ellisville, Columbia County, Florida (hereafter referred to as the "project site"). Refer to **Figure 1** for a Project Site Location and Vicinity Map. These services were performed in general accordance with ASC Proposal No. 08051G dated 2 October 2008.

1.2 Project Description and Background

Based on a review of the information and architectural site plan provided by the Client and site reconnaissance, project details are summarized below:

- ▶ the project entails construction of a patented circular potable water storage tank manufactured by Crom corporation of Gainesville, Florida;
- ▶ the proposed tank will consist of 6 in. thick floor, 4 in. thick walls, 4 in. thick dome top, and will hold approximately 250,000 gallons of water;
- ▶ the tank is proposed to be approximately 45 ft in diameter and 23 ft in height and will be placed approximately 2.0 ft below existing ground surface (egs);
- ▶ a CAD site plan was provided by the Client (email correspondence dated 20 October 2008); and,
- ▶ the boring locations were selected and marked by the Client;

Limitations of the work performed for this project, including this report itself, are discussed in Section 6.0.

1.3 Purpose and Scope of Work

The purpose of the geotechnical exploration, data evaluation, and engineering consultation services completed by ASC for the project site was to describe, in general terms, soil and ground-water conditions encountered at the site and to evaluate the subsurface conditions

relative to design and construction of foundations for the proposed structure. To achieve this purpose, the scope of services included the following elements:

- ▶ advancing three (3) test borings to a depth of approximately 25.0 to 60.0 ft below eggs at locations marked and designated by the Client; boring depth and locations were selected by the Client;
- ▶ obtaining representative soil and rock samples from the test borings;
- ▶ backfilling and grouting the boreholes in general accordance with applicable guidelines;
- ▶ reviewing soil samples and performing laboratory tests on selected samples to evaluate pertinent engineering characteristics of the soil and assist in their classification;
- ▶ evaluating generalized boring data as well as ground-water conditions;
- ▶ compiling the field exploration data, laboratory testing data, and engineering recommendations in this report; and,
- ▶ providing two (2) copies of original signed and sealed reports by a registered engineer of the firm plus an electronic version on CD.

2.0 FIELD EXPLORATION AND LABORATORY TESTING PROGRAM

2.1 Field Exploration Program

As discussed in **Section 1.3** above, subsurface conditions within the project site were explored by advancing three (3) test borings, at locations selected by the Client and as illustrated in **Figure 3** (Project Layout and Test Location Plan). The field exploration program was performed on 6 October 2008.

2.1.1 Test Borings

The test borings were advanced by a truck-mounted drill rig using a wet-rotary procedure. Representative soil samples were obtained using the split-barrel sampling procedure discussed below. In this procedure, a 2-in. outer-diameter, split-barrel sampler is driven into the soil by a 140-lb hammer with a free-fall of 30-in. The number of blows required to

drive the sampler through a 12-in. interval is termed the Standard Penetration Resistance, or "N", value, and is indicated for each sample on the boring log. The "N" value may be taken as an indication of the relative density of granular soils in-situ.

Samples obtained from the field exploration program and not subject to laboratory testing have been stored at ASC's laboratory. These samples will be retained for 60 days from the date of release of this report unless specified otherwise by the Client in writing.

2.2 Laboratory Testing Program

Laboratory tests are generally performed to assist in the classification of soils based on their mechanical and physical behavior. Based on the results of laboratory tests, an indication of physical properties for a soil can be determined. Laboratory tests completed on soil samples retrieved for this project include:

- ▶ six (6) moisture content determinations;
- ▶ five (5) minus #200 sieve tests;
- ▶ one (1) Atterberg limit test; and,
- ▶ visual classification in general accordance with ASTM D 2488.

As noted above, results for each of these laboratory tests are summarized at the respective sample depths on the boring logs (**Figure 4**).

3.0 SITE, GROUND-WATER, AND SOIL CONDITIONS

3.1 Site Features

The project site is located off Wire Road in Ellisville, Columbia County, Florida, as illustrated on the Project Site Location and Vicinity Map presented in **Figure 1**. The site slopes moderately towards the east, southeast, and south and is clear of any major obstructions. The site is bound by a vacant lot to the north, a ditch to the south, Wire Road to the west, and Interstate 75 to the east.

3.2 Estimated Seasonal High Water Levels

At the time of the field exploration program, ground-water was observed at a depth approximately 50.3 ft below egs immediately upon completion of drilling. Based on information from the USDA-SCS, the surficial shallow geology of the project site is dominated by Albany fine sand (Map Unit "1") 0 to 5 percent slopes, Blanton fine sand (Map Unit "8") 0 to 5 percent slopes, and Lucy loamy fine sand (Map Unit "34") 2 to 5 percent slopes (refer to **Figure 2** for USDA-SCS Soil Survey Map). The published Seasonal High Water Level (SHWL) for these soils is approximately 12 to 48 in.

Fluctuation in any ground-water level should be expected due to seasonal climatic changes, construction activity, development activities, rainfall variations, surface-water runoff, and other site specific factors. Since ground-water level variations are anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based on the assumption that variations will occur.

3.3 Subsurface Soil Conditions

General subsurface soil conditions at boring locations for each structure on the project site are described below, from the egs to the termination depth of the borings (refer to **Figure 3** for Project Layout and Test Location Plan).

- ▶ General subsurface soils encountered consisted of loose **poorly-graded sand (SP)**, firm to very hard **sandy clay to clayey sand (CL-SC)**, and medium dense **weathered limestone (WLS)** from the egs to boring termination depths of approximately 25.0 to 60.0 ft.

Detailed description of materials encountered in each of the borings is included in the boring logs presented in **Figure 4**. Additionally, a subsurface soil stratigraphy under the tank area is illustrated in **Figure 6**.

4.0 OBSERVATIONS, CONCLUSIONS, AND RECOMMENDATIONS

Based on current conditions, data obtained during the field exploration, information provided by the Client, and laboratory testing program for this project, our observations, conclusions, and recommendations are presented below.

4.1 Geotechnical Evaluation

- ▶ This project specific tract as well as this general area of Columbia County is historically known to be a sinkhole prone area.
- ▶ This evaluation of subsurface geotechnical conditions relating to the project has been based on our site observations, soil test boring data performed by ASC, and our review of available information from Florida Geological Survey (FGS) database. In evaluating the test boring data, ASC has used previous characteristics which have been observed for soils similar to those encountered at this site as well as our knowledge of this specific area in Ellisville, Columbia County, Florida.
- ▶ The presence of, or potential for, solution channels to transmit soil particles cannot be directly evaluated. The presence of abnormally loose subsoil conditions with partial or total loss of drilling fluid circulation, and with dropping of drill rod in soils which would normally be impervious to the thick bentonite slurry is an indicator that conveying seepage passages may exist. This occurrence, coupled with the presence of very loose sandy soils of an erodible texture and composition, and immediately underlain by limestone would suggest a potential for or evidence of the internal soil erosion process.
- ▶ A key element is to establish the presence of a raveling zone of soft or loose soils that extend from limestone bedrock sufficiently close to the surface to cause subsidence. Alternatively, significant evidence of downward movement of surficial soils may also be indicative of karst related subsidence. It should be noted that local zones of circulation loss in SPT borings, isolated soft or loose soil layers, or buried depressions in the clay or bedrock surface, in the absence of significant raveling or other evidence of downward movement of soils, is not necessarily positive evidence of sinkhole activity.
- ▶ Paleosink condition is a phenomenon that represents certain direct and derived characteristics in limestone (variable depth, solutioning, erodible zone represented by loss of circulation of drilling fluid in solution riddled limestone). This condition of limestone was observed in the general vicinity of test boring SB-2 which was terminated into the limestone.

- ▶ A map showing locations of documented sinkholes as per FGS database and depressions/sinkholes as per USDA map are illustrated in **Figure 5**. A total of tow (2) documented depressions/sinkholes have occurred, and have been documented, within 1/2 mile radius of this site.
- ▶ If the Client has concern about any site specific sinkhole related activity, then deeper borings and/or geophysical survey (ER or MER) should be performed, and is recommended.
- ▶ Site specific clayey soils encountered during the field exploration program are known to have low to moderated swelling potential. As a precautionary measure any clayey soils encountered within 3.0 ft of the footing bearing elevation may require excavation and replacement with non-expansive compacted structural fill. It is further recommended that at least 5.0 ft outside the exterior limits of the foundation be excavated and replaced by compacted non-expansive structural fill material around the footing wherever these expansive clays are encountered.
- ▶ Special precautions should be taken to divert the surface water runoff away from the tank structure areas because of the presence of shallow clays. Accordingly due consideration should be given towards installation of upslope underdrain systems to contain and carry the surface water runoff away from the building foundations.

4.2 Site Specific Comments

- ▶ Based on the 3 borings performed by ASC within the proposed structural areas and review of the subsoil information developed from test borings, the chances of an existing subsurface erodible zone and/or initiation of failure process leading to increased solution activity are minimized due to the fact that stiff to very hard predominantly cohesive soils from underlie the shallow overburden sands (6.0 to 7.0 ft) and overlie the limestone existing at 35.0 ft depth.
- ▶ In view of the anticipated contact pressure of 1,400 psf, the footing sizes, and the soil–structure interaction limitations, the governing geotechnical design criteria at this project site will be settlement control and not bearing pressure.

- ▶ Due to the presence of stiff to very stiff shallow clays in the top 6.0 to 25.0 ft zone below egs, specially in the vicinity of SB-1, a net allowable soil bearing pressure of 1,800 psf can be utilized for design exclusive of any settlement considerations;
- ▶ A patented Crom tank construction is contemplated at the project site as per the information provided by the Client;
- ▶ Any specific considerations/information required by the tank manufacturer can be provided upon request.
- ▶ It is recommended by ASC that the top 6.0 ft of sands be compacted utilizing a Dynapac CA-25. In order to achieve a uniform mechanical densification throughout the tank footprint, excavation of soils to 2.0 ft below egs and to 5.0 ft outside the tank limits is recommended and the excavated surface should be compacted and tested prior to replacement of the excavated material with compacted and tested fill material.
- ▶ A total settlement of approximately 2.5 and 0.5 in. was calculated, at the center of the tank, with the tank filled to full capacity with water and with the tank empty, respectively.
- ▶ Proper allowance for 2.0 in. of total settlement, between the center and edges of the tank, should be accounted for (by the tank manufacturer), in establishing the tank floors finish surface.

4.3 Site Preparation, Fill Placement, and Inspection

- ▶ All structural areas, including 5.0-ft outside their limits, should be stripped, excavated, and undercut of all obstructions, topsoil, and other organic or deleterious materials. In localized areas where organics/roots or other deleterious materials extend to greater depths, further excavation and backfilling may become necessary. Fill should not be placed until the excavated surface has been inspected by an ASC representative and approved for compaction and placement of structural backfill operations.
- ▶ All stripped or undercut areas should be proof-rolled with appropriate compaction equipment for site and soil conditions. This would typically consist of a vibratory drum type compactor such as Dynapac CA-25 (or

engineer approved alternate) for sandy soils. The moisture content should be adjusted as necessary to aid compaction efforts.

- ▶ Care should be taken to avoid damage to any nearby or adjacent structures while compaction operations are ongoing. Prior to initiating compaction operations occupants of nearby or adjacent structures should be notified and the existing conditions of the structures should be documented with photographs and survey (if deemed necessary). Compaction should cease if deemed potentially detrimental to nearby or adjacent structures and ASC should be contacted immediately. It is recommended a vibratory roller maintain a minimum separation of 30-ft from existing structures. Within this zone use of a track-mounted bulldozer or a vibratory roller operating in a static mode is recommended.
- ▶ In any areas observed to be “yielding” or “pumping” during compaction operations, localized cuts or trenches may be made to evaluate the conditions of the soils.
- ▶ As indicated above, localized unstable areas or areas containing organics/roots or other deleterious materials discovered during stripping and compaction may require excavation and backfilling. An ASC representative should be present during the proof-rolling and compaction operations.

4.3.1 Structural Areas Requiring Fill

- ▶ When placing fill materials, lift thicknesses not greater than 12-in. prior to compaction, should be maintained at any one time. Each lift should be placed, compacted, and tested prior to placement of the next lift. Field density tests should be performed to at least 1.0-ft below the stripped, excavated, proof-rolled, and compacted surface of natural soils. Additional field density tests should be performed for each 1.0-ft lift of fill placed. Any areas not in compliance with the compaction requirements should be reworked and retested prior to placement of the next lift of fill. It is recommended that a field density test be performed for every 2,000 sq ft of the structural areas.
- ▶ All fill material in the proposed structural areas should be compacted to 95 percent of the maximum dry density determined from ASTM D 1557, *Test Method for Compaction Characteristics Using Modified Effort* or 98

percent of the maximum dry density determined from ASTM D 698, *Test Method for Compaction Characteristics Using Standard Effort*.

- ▶ Fill materials required to achieve elevated structural pad areas should preferably consist of select fill containing less than 10 percent fines (i.e., less than 10 percent passing the # 200 sieve). It is noted that select fill towards the upper end of this limit (i.e., 7 to 10 percent fines) may require strict moisture control during compaction. Additionally, select fill would be free of organics and other deleterious materials. These soil types are less sensitive to moisture problems than other more silty or clayey soils so the use of select fills tends to reduce earthwork delays caused by seasonal rains.

4.3.2 Structural Areas Requiring Cut

- ▶ Foundation bearing soils within the structural footprint should be excavated to the proposed bottom of footing elevations utilizing every effort to minimize disturbance of the soils resting at the bearing surface. Next, the foundation bearing soils should be tested for compaction to a target of 95 percent of the maximum dry density determined from ASTM D 1557, *Test Method for Compaction Characteristics Using Modified Effort* or 98 percent of the maximum dry density determined from ASTM D 698, *Test Method for Compaction Characteristics Using Standard Effort*. The bearing surface, including all areas within the structural footprint, must be inspected and tested to 1.0-ft below the prepared undercut elevation and approved by an ASC representative.
- ▶ If any foundation bearing soils are determined to be deficient, then the footing bottoms should be compacted utilizing hand-held compaction equipment to achieve the compaction criterion outlined above. Overexcavation and recompaction may be necessary to fulfill the compaction criterion. It is important to note that the moisture content should be strictly controlled during any compaction procedures.

4.4 Foundations

Based on the results of the field exploration, laboratory testing, and inspection programs, and the loading information provided we consider the subsurface conditions at the site are adequate to favorable for support of the proposed structure on a properly designed

conventional shallow foundation system. Provided the site preparation and earthwork construction recommendations outlined in **Sections 4.3** of this report are performed, a conventional shallow foundation system may be designed in accordance with the guidelines listed below.

The structures may be designed utilizing a net allowable soil bearing pressure of 1,800 psf. Net bearing pressure is defined as the soil bearing pressure at the foundation bearing level in excess of natural overburden pressure at that level. The foundations should be designed based on the maximum load which could be imposed by all loading conditions.

Utilizing these allowable net soil bearing pressures, the estimated total settlement is on the order of 2.0 in. in the center of the tank. These settlements will be a combination of both long and short term and should be accounted for, in the structural and foundation design.

Regarding settlement in general, subsurface soil movements at the site will occur as a consequence of several interrelated stress conditions. The amount of movement which individual footings will experience is a function of the footing size and the imposed pressure intensity as well as the in-situ stress conditions within the zone influenced by the footing. Settlement estimations are based on empirical procedures using SPT-values as a measure of relative in-situ density of soils.

5.0 CONSTRUCTION CONSIDERATIONS

Due to nature of the site subsurface conditions, it is imperative that ASC be retained to provide and perform the engineering and quality control testing services during the construction phase of the project. The services to be provided by ASC include:

- ▶ monitoring proof rolling operations as well as placement and testing of engineered and compacted fill to FFE; and
- ▶ general quality control testing during construction.

A sound geotechnical engineering evaluation does not end with the final design. Design is an ongoing process throughout construction. Because of ASC's familiarity with the project site, its condition as related to geotechnical design elements, and the intent of the engineering design, we are most qualified to address issues during construction as well as to evaluate problems which may arise during construction.

Mr. Mark Neihaus
Eutaw Utilities, Inc.
**Geotechnical Exploration, Data Evaluation,
and Engineering Consultation Services Report**
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida
ASC Project No. 08G2006
ASC Document No. 080306L

ASC geosciences, inc.
29 October 2008

6.0 LIMITATIONS

6.1 General

This geotechnical engineering services report has been prepared solely for the exclusive use of the Client, **Eutaw Utilities, Inc.**, in accordance with generally accepted geotechnical engineering standards. No other warranty is expressed nor implied. It should be noted that the information presented in this report addresses only soils and deposits normally influenced by the proposed construction. Other conditions may exist which were not detected or were not made known to ASC.

For additional reference describing the scope and limitations of this project, please review the document enclosed in **Appendix A** entitled *Important Information About Your Geotechnical Engineering Report* prepared by the American Society of Foundation Engineers (ASFE).

6.2 Scope of Services

This report has been prepared to aid in the evaluation of subsurface conditions only at the locations of test borings illustrated in **Figure 3**. The scope of services is limited to the specific project and location described herein, and the description of the project represents ASC's understanding of significant project aspects related to soil characteristics. In the event that any changes in the design or location of the structure as outlined in the report are planned, ASC must be informed so that the changes can be reviewed and the observation, comments, and conclusions of this report modified or approved in writing. **Any conclusions or recommendations made by others based on the data contained herein are not the responsibility of ASC, unless we are given the opportunity to review those conclusions and recommendations.**

6.3 Changed Conditions

The information submitted in this report is based upon the data obtained from borings performed at locations indicated in the Project Layout and Test Location Plan and from any other information discussed in this report. **The report does not reflect any variations which occur between these borings. In the performance of subsurface exploration, specific information is obtained at specific locations at specific times. However, it is known that site and subsurface conditions can change with time and under anthropologic influences. Additionally, variations in soil, rock, and ground-water conditions exist on most sites between boring locations.** The nature and extent of the variations may not become

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29 October 2008

evident until construction. If variations then appear, it will be necessary to re-evaluate the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of any variations.

It is the responsibility of the Client to see that the recommendations in this report are brought to the attention of all concerned parties. Because of the possibility of unanticipated subsurface conditions occurring, it is recommended that a "changed condition" clause be provided in contracts with the general contractor and with subcontractors involved in foundations or earthwork construction. Furthermore, it is recommended that ASC be retained to review the site preparation and foundation phases of construction. Otherwise, no responsibility for construction compliance with the design concepts, plans, specifications, and recommendations presented herein can be assumed.

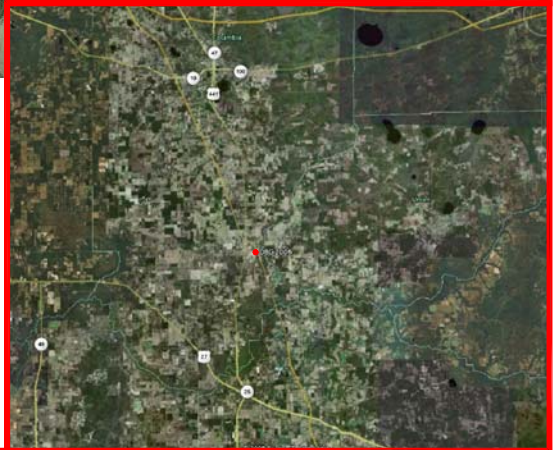
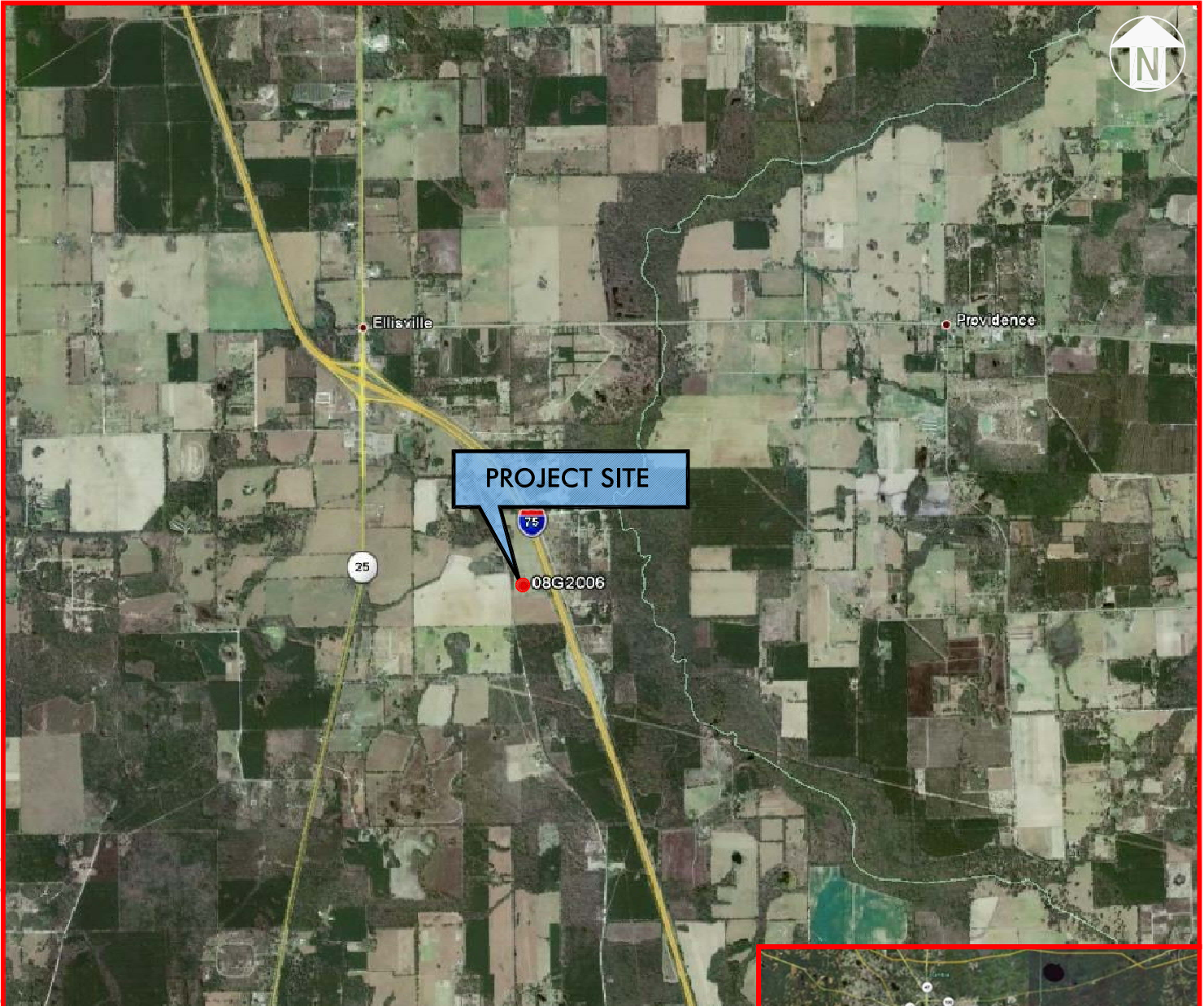
6.4 Reproduction

The reproduction of any portion of this report in plans or other engineering documents supplied to parties other than the Client or assigned parties must bear the language indicating that the information contained in the report is for general information only, and that neither the Client nor ASC are liable to such parties.

7.0 REFERENCES

Internet: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.asp>

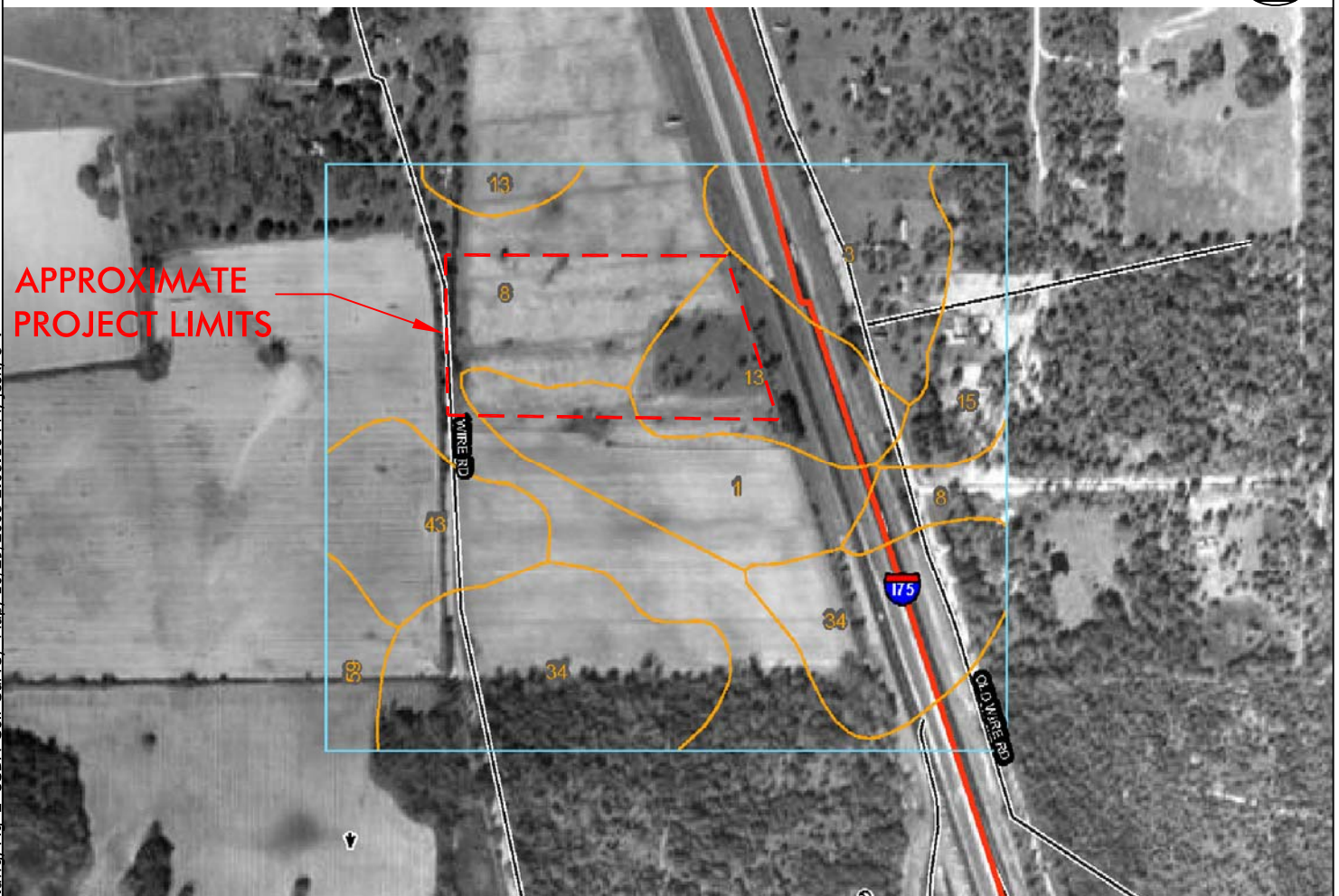
V:\Asc-LakeCity\2000-Geotech\2008\08G2006_Ellisville_Storage_Tank\ASC_Dwgs\08G2006.dwg, Fig# 1 Site Location Map, 10/22/2008 4:52:44 PM, jcox, 8-V



WGS84
LAT: N
LONG: W
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TITLE Project Site Location and Vicinity Map		SOURCE Google Earth	FIGURE NO. 1
 ENGINEERING A BETTER WORLD™ www.ascworld.net	DATE 14 October 2008	Geotechnical Exploration and Engineering Consultation Services Report Proposed Ellisville Storage Tank off Wire Road Ellisville, Columbia County, Florida for: Mr. Mark Neihaus, Project Manager Eutaw Utilities Inc., Tallahassee, Florida	
	DRAWN BY JBC		
	CHECKED BY JS		
	SCALE nts		
	PROJECT NO. 08G2006		

V:\Asc-LakeCity\2000-Geotech\2008\08G2006 Ellisville Storage Tank\ASC_Dwgs\08G2006.dwg, Fig. 2 USDA Soil Survey Map, 10/29/2008 2:08:16 PM, icox, 8-V



WGS84
LAT: 29.984818° N
LONG: 82.583636° W
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TITLE

USDA-SCS Soil Survey Map

SOURCE

USDA-SCS Soil Survey
Columbia County, Florida [Online]

FIGURE NO.

2

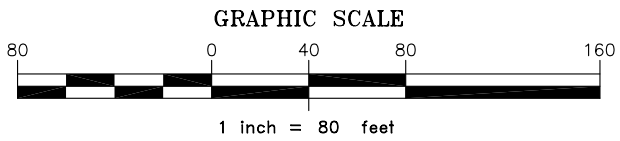
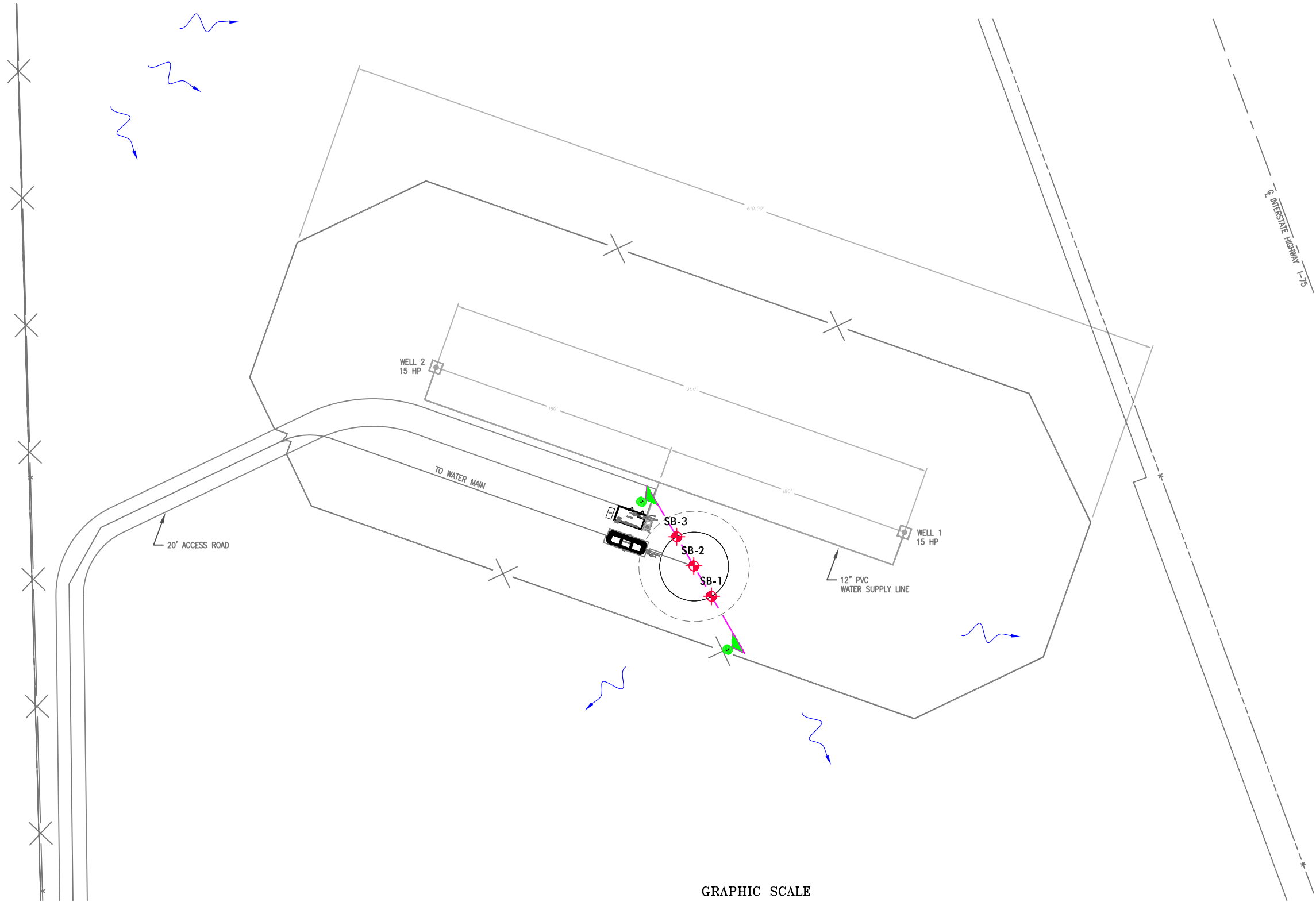


DATE 14 October 2008
DRAWN BY JBC
CHECKED BY JS
SCALE nts
PROJECT NO. 08G2006

LEGEND	
Columbia County	
Map Unit Symbol	Map Unit Name
1	Albany fine sand, 0 to 5 percent slopes
8	Blanton fine sand, 0 to 5 percent slopes
34	Lucy loamy fine sand, 2 to 5 percent slopes

Geotechnical Exploration and Engineering
Consultation Services Report
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida
for:
Mr. Mark Neihaus, Project Manager
Eutaw Utilities Inc., Tallahassee, Florida

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LEGEND

SB-1 SPT Boring(s) Location and Identification.

Moderately Sloping Site

Note: This is not a survey.
Boring and test locations are approximate.

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NO.	REVISIONS	DATE	BY	NAME	DATE
				DESIGNED	
				DRAWN	JBC 10/08
				CHECKED	JS 10/08
				APPROVED	AS 10/08



PROJECT NAME

Proposed Ellisville Storage Tank

off Wire Road
Ellisville, Columbia County, Florida

CLIENT

Mr. Mark Neihaus
Project Manager
Eutaw Utilities Inc.
Tallahassee, Florida

SHEET TITLE

Project Layout and Test Location Plan

SOURCE

Base map provided by:
Client

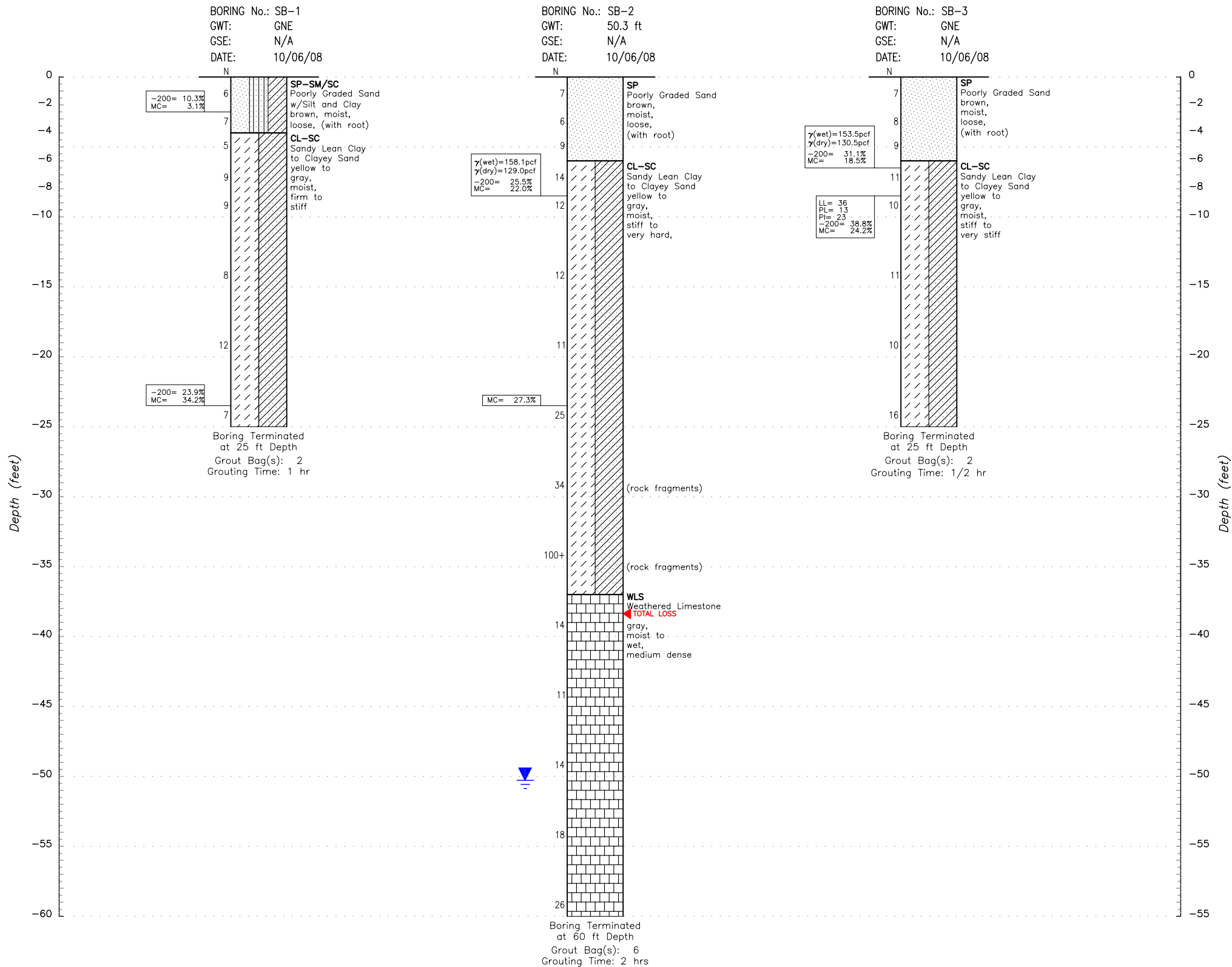
PROJECT NO.

08G2006

Figure No.

3

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LEGEND					
	SP SAND		ML SILT		MH ELASTIC SILT
	SM SILTY SAND		CL LEAN CLAY		CH FAT CLAY
	SC CLAYEY SAND		SH SHELL		PT MUCK/PEAT
	LS HARD LIMESTONE		-- SHELLY-GRAVEL		-- CONCRETE
	WLS WEATHERED OR SOFT LIMESTONE		-- SHELLY-SAND		AS ASPHALT
	SP-SC		-- SHELLY-CLAY		LB LIMESTONE BASE
	SP-SM		-- SOIL/CEMENT		-- DEBRIS
	-- CAVITY		OL ORGANIC SILTS		OH ORGANIC CLAY
	GM SILTY-GRAVEL		GC GRAVELLY-CLAY		GP GRAVEL

SOIL PROPERTIES

GRANULAR SOILS (COHESIONLESS)

DESCRIPTIVE TERM FOR RELATIVE DENSITY	SPT N-VALUE (blows per ft)
very loose	0 - 4
loose	5 - 10
medium dense	11 - 30
dense	31 - 50
very dense	over 50

FINE GRAINED SOILS (COHESIVE)

DESCRIPTIVE TERM FOR CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (ksf)	SPT N-VALUE (blows per ft)
very soft	0.5	0 - 2
soft	0.5 - 1.0	3 - 4
firm	1.0 - 2.0	5 - 8
stiff	2.0 - 4.0	9 - 15
very stiff	4.0 - 8.0	16 - 30
hard	8.0-10.0	31-50
very hard	10.0+	over 50

MOISTURE DESCRIPTION

- dry - absence of moisture, dusty, dry to the touch
- moist - damp, but no visible water
- wet - visible free water, usually soil is below water table

- GNE GROUND WATER NOT ENCOUNTERED
- GNM GROUND WATER NOT MEASURED
- LL LIQUID LIMIT
- PL PLASTIC LIMIT
- PI PLASTICITY INDEX
- 200 PERCENT PASSING NO. 200 U.S. STANDARD SIEVE (%)
- MC NATURAL MOISTURE CONTENT (%)
- WR WEIGHT OF ROD
- WOH WEIGHT OF HAMMER
- N STANDARD PENETRATION RESISTANCE IN BLOWS PER 1ft (2ft SPOON - ASTM D-1586)
- ORG ORGANIC CONTENT
- TOD TIME OF DRILLING
- GSE GROUND SURFACE ELEVATION
- CASING USED
- USCS SOIL CLASSIFICATION
- LOSS OF CIRCULATION
- NO RECOVERY

- GWT or GROUND WATER TABLE LEVEL (OBSERVED)
- SHWL or SEASONAL HIGH WATER LEVEL (ESTIMATED)
- TYPE OF RIG: IRA 200 (Manual Hammer)

NOTES:

- THE BORINGS SHOWN REPRESENT SUBSURFACE CONDITIONS WITHIN THE BOREHOLE AT THE TIME OF DRILLING, NO WARRANTY AS TO THE SUBSURFACE CONDITIONS, STRATA DEPTH OR SOIL CONSISTENCY BETWEEN OR OUTSIDE THE BORING LOCATIONS IS EXPRESSED OR IMPLIED BY THIS DRAWING. DO NOT ASSUME THIS DATA IS A GUARANTEE OF THE DEPTH, EXTENT, OR CHARACTER OF THE MATERIAL PRESENT.
- REFER TO PROJECT LAYOUT AND BORING LOCATION PLAN (FIGURE 3) FOR TEST LOCATIONS.

08G2006.dwg (10-14-2008)

NO.	REVISIONS	DATE	BY	NAME	DATE
	DESIGNED				
	DRAWN	10/08	JBC		
	CHECKED	10/08	AS		
	APPROVED	10/08	AS		

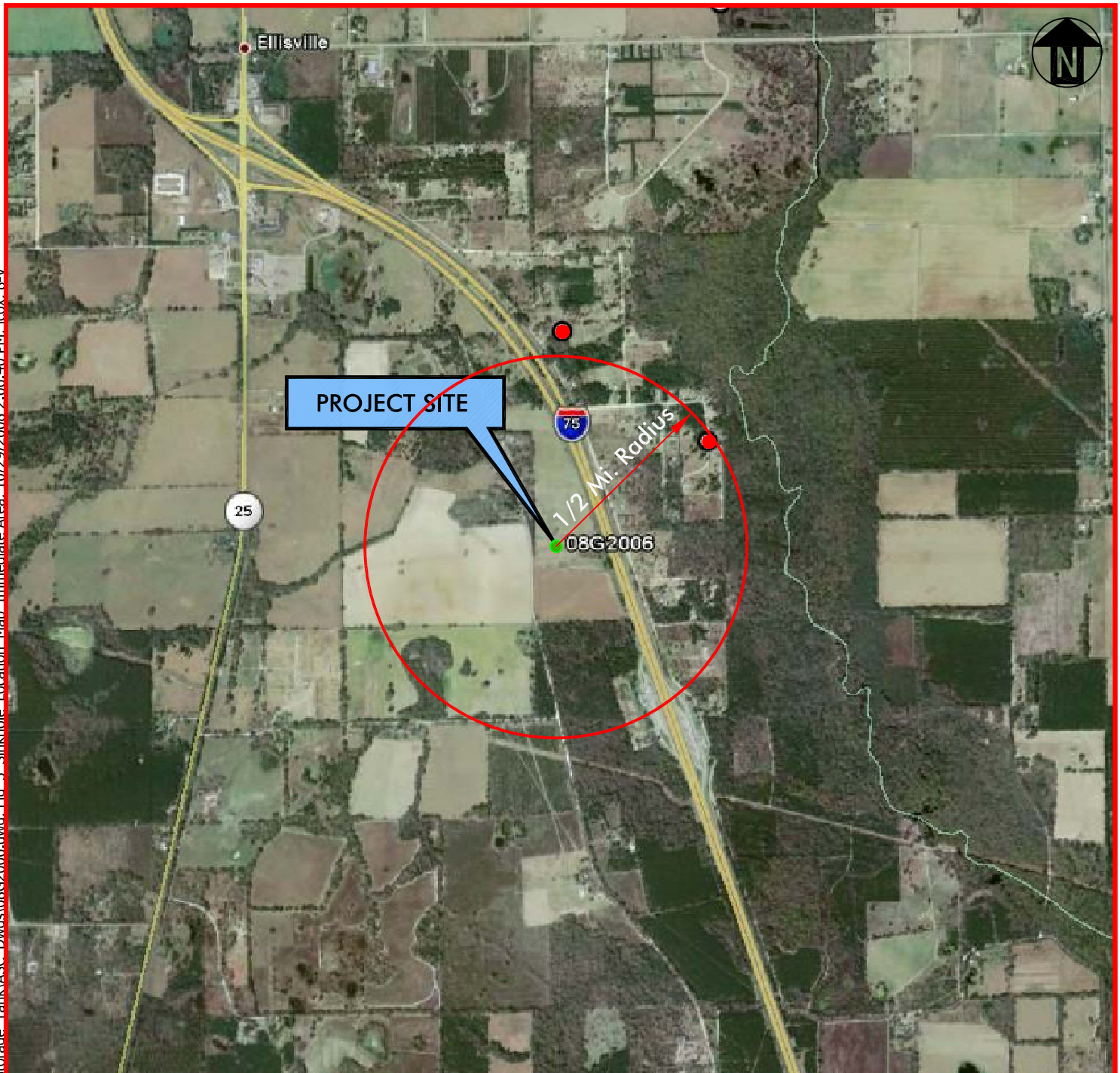


PROJECT NAME
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CLIENT
Mr. Mark Neihaus
Project Manager
Eutaw Utilities Inc.
Tallahassee, Florida

SHEET TITLE		Figure No.
Boring Log Profiles		4
SOURCE	PROJECT NO.	
---	08G2006	

V:\Asc-LakeCity\2000-Geotech\2008\08G2006_Ellisville Storage Tank\ASC_Dwgs\08G2006.dwg, Fig. 5 Sinkhole Location Map Immediate Area, 10/29/2008 2:06:40 PM, icox, 8-V



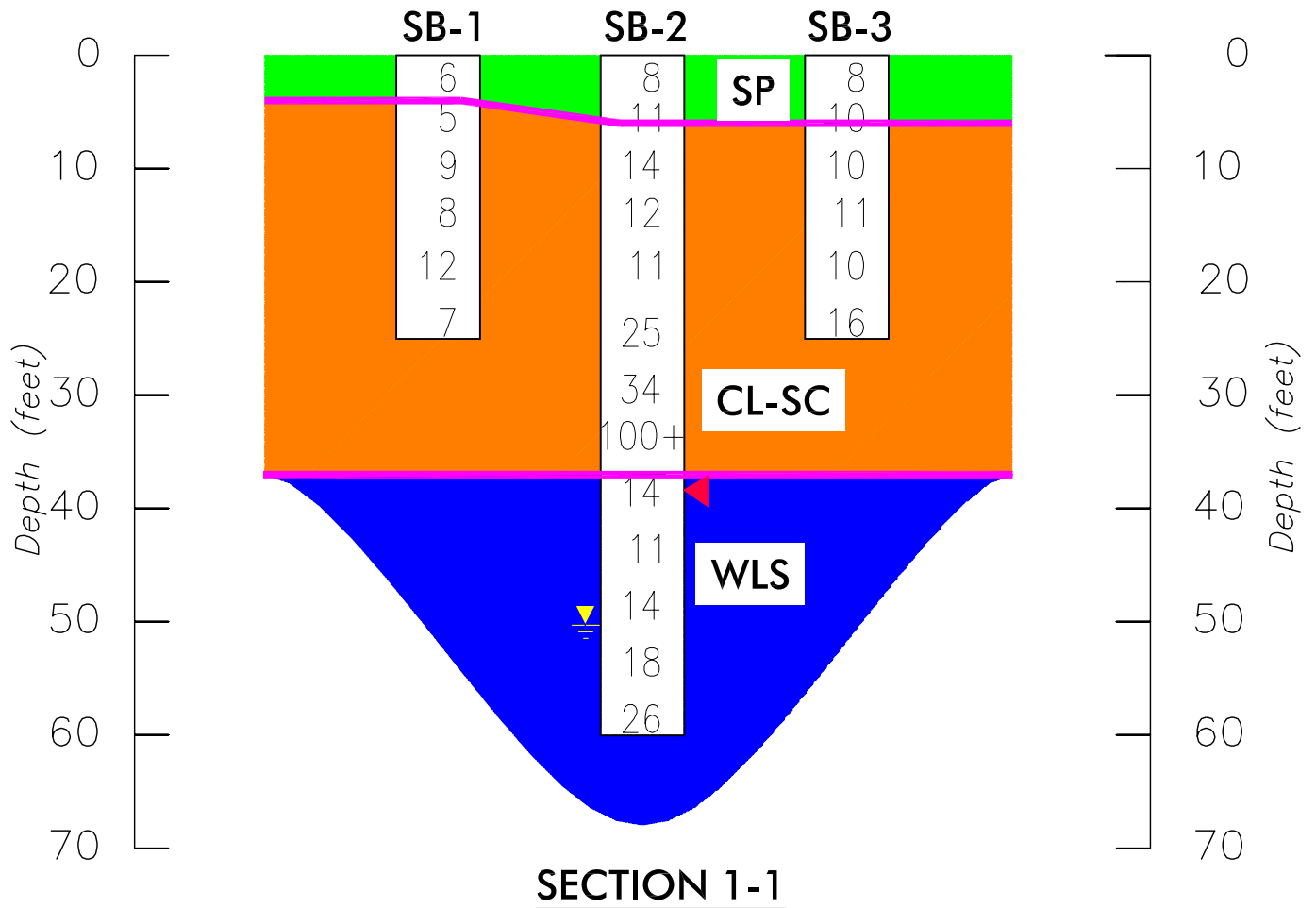
WGS84
LAT: 29.984818° N
LONG: 82.583636° W
08G2006.dwg (10-14-2008)

LEGEND

- Documented Sinkhole Location(s)
- Project Site Location

TITLE		SOURCE	FIGURE NO.
Location of Documented and Other Reported Sinkholes in Columbia County, Florida within 1/2 mile of Project Site		FGS Database	5
 ENGINEERING A BETTER WORLD™ www.ascworld.net	DATE	Geotechnical Exploration and Engineering Consultation Services Report Proposed Ellisville Storage Tank off Wire Road Ellisville, Columbia County, Florida for: Mr. Mark Neihaus, Project Manager Eutaw Utilities Inc., Tallahassee, Florida	
	DRAWN BY		
	CHECKED BY		
	SCALE		
	PROJECT NO.		
		14 October 2008	
		JBC	
		JS	
		nts	
		08G2006	

V:\Asc-LakeCity\2000-Geotech\2008\08G2006 Ellisville Storage Tank\ASC Dwg\08G2006.dwg, Fig. 6 Subsurface Stratigraphy, 10/29/2008 3:00:41 PM, jcox, 8-V



LEGEND	
	TOTAL LOSS OF DRILLING FLUID
	GWT or GROUND WATER TABLE LEVEL
	SP SAND
	CL-SC LEAN CLAY TO CLAYEY SAND
	WLS WEATHERED LIMESTONE

WGS84
LAT: 29.984818° N
LONG: 82.583636° W
08G2006.dwg (10-14-2008)

TITLE		SOURCE	FIGURE NO.
Subsurface Soil Stratigraphy			6
 ENGINEERING A BETTER WORLD™ www.ascworld.net	DATE	Geotechnical Exploration and Engineering Consultation Services Report Proposed Ellisville Storage Tank off Wire Road Ellisville, Columbia County, Florida for: Mr. Mark Neihaus, Project Manager Eutaw Utilities Inc., Tallahassee, Florida	
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		JS	
		nts	
		08G2006	

Mr. Mark Neihaus
Eutaw Utilities, Inc.

**Geotechnical Exploration, Data Evaluation,
and Engineering Consultation Services Report**
Proposed Ellisville Storage Tank
off Wire Road
Ellisville, Columbia County, Florida
ASC Project No. 08G2006
ASC Document No. 080306L

ASC geosciences, inc.
29 October 2008

APPENDIX A

Important Information About Your Geotechnical Engineering Report by ASFE

Important Information About Your Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one—not even you—*should apply the report for any purpose or project except the one originally contemplated.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,

- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions *only* at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an *opinion* about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject To Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the

report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations", many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any *geoenvironmental* findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own *geoenvironmental* information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Rely on Your Geotechnical Engineer for Additional Assistance

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.



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