COLUMBIA COUNTY
NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT

BIDDING AND CONSTRUCTION
CONTRACT DOCUMENTS AND
TECHNICAL SPECIFICATIONS

BID SUBMITTAL

Jones Edmunds Project No.: 03780-001-01

Owner:

COLUMBIA COUNTY
135 NE Hernando Avenue
Lake City, Florida 32055

Engineer:

JONES EDMUNDS & ASSOCIATES, INC.
730 NE Waldo Road
Gainesville, Florida 32641

April 2022

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OWNER-PROVIDED
CONTRACT DOCUMENTS

CONSTRUCTION AGREEMENT

COLUMBIA COUNTY, a political subdivision of the State of Florida, by and through its Board of County Commissioners, situated at 135 NE Hernando Avenue, Suite 203, Lake City, Florida 32056-1529 (the "County"), hereby contracts with _____ (the "Contractor") of _____ (address) a contractor licensed to perform all work in the State of Florida in connection with the County's Project No._____ (the "Project"), as said work is set forth in the Plans and Specifications and other Contract Documents hereafter specified (the "Work"). The designated Engineer for the Project and the Work, as referenced in this Agreement, shall be _____ _____ _____.

The County and the Contractor, for the consideration herein set forth, agree as follows:

Section 1. Contract Documents

The Contract Documents consist of this Agreement, the Exhibits described in Section 4 hereof, the Legal Advertisement, the Instructions to Bidders, the Proposal and any duly executed and issued addenda, Change Orders, Work Directive Changes, Field Orders, Work Authorizations and amendments relating thereto. All of the foregoing Contract Documents are incorporated by reference and made a part of this Agreement (all of said documents including the Agreement sometimes being referred to herein as the "Contract Documents" and sometimes as the "Agreement"). A copy of the Contract Documents shall be maintained by Contractor at the Project site at all times during the performance of the Work.

Section 2. Scope of Work

The Contractor agrees to furnish and pay for all management, supervision, financing, labor, materials, tools, fuel, supplies, utilities, equipment and services of every kind and type necessary to diligently, timely, and fully perform and complete in a good and workmanlike manner the Work required by this Agreement.

Section 3. Contract Amount

In consideration of the faithful performance by the Contractor of the covenants in this Agreement to the full satisfaction and acceptance of the County, the County agrees to pay, or cause to be paid, to Contractor the following amount (herein "Contract Amount"), in accordance with the terms of this Agreement: $_____ (_____ _____ _____).

[INSERT SCHEDULE OF UNIT PRICES AS APPLICABLE]

Section 4. Exhibits Incorporated

The following documents are expressly agreed to be incorporated by reference and made a part of this Agreement:

A. Legal Advertisement
B. Invitation to Bid
C. Bid Proposal with required forms
D. Performance Bond
E. Public Payment Bond
F. Insurance Requirements, including certificates of insurance
G. Form of Release and Affidavit
H. Change Order Form
I. Notice of Award
J. Notice to Proceed Form
K. Application for Payment Form
L. Special Conditions, if any
M. Project Plans
N. _____
O. _____
P. _____

Section 5. Bonds

A. The Contractor shall provide Performance and Payment Bonds, in the form prescribed in the Exhibits to the Agreement, in the amount of 100% of the Contract Amount, the costs of which are to be paid by Contractor. The Performance and Payment Bonds shall be underwritten by a surety authorized to do business in the State of Florida and otherwise acceptable to the County; provided, however, the surety shall be rated as "A-" or better as to general policy holders rating and Class V or higher rating as to financial size category and the amount required shall not exceed 5% of the reported policy holders surplus, all as reported in the most current Best Key Rating Guide, published by A.M. Best Company, Inc. of 75 Fulton Street, New York, New York 10038.

B. If the surety for any bond furnished by Contractor is declared bankrupt, becomes insolvent, its right to do business is terminated in the State of Florida, or it ceases to meet the requirements imposed by the Contract Documents, the Contractor shall, within five (5) calendar days thereafter, substitute another bond and surety, both of which shall be subject to the County's approval.

Section 6. Contract Time and Liquidated Damages

A. Time is of the essence in the performance of the Work under this Agreement. The "Commencement Date" shall be established in the Notice to Proceed to be issued by the County. The Contractor shall commence the Work within five (5) calendar days from the Commencement Date. No Work shall be performed at the Project site prior to the Commencement Date. Any Work performed by the Contractor prior to the Commencement Date shall be at the sole risk of the Contractor. The Work shall be substantially completed within _____ calendar days from the

Commencement Date. The date of substantial completion of the Work (or designated portions thereof) is the date certified by the Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the County can occupy or utilize the Work (or designated portions thereof) for the use for which it is intended. The Work shall be fully completed and ready for final acceptance by the County within _____ calendar days from the Commencement Date (herein "Contract Time").

B. The County and the Contractor recognize that, since time is of the essence for this Agreement, the County will suffer financial loss if the Work is not substantially completed within the time specified above, as said time may be adjusted as provided for herein. Should the Contractor fail to substantially complete the Work within the time period noted above, the County shall be entitled to assess, as liquidated damages, but not as a penalty, _____[1] for each calendar day thereafter until substantial completion is achieved. The Project shall be deemed to be substantially completed on the date the Engineer issues a Substantial Completion Certificate pursuant to the terms hereof. The Contractor hereby expressly waives and relinquishes any right which it may have to seek to characterize the above noted liquidated damages as a penalty, which the parties agree represents a fair and reasonable estimate of the County's actual damages at the time of contracting if the Contractor fails to substantially complete the Work in a timely manner.

C. When any period of time is referenced by days herein, it shall be computed to exclude the first day and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation, and the last day shall become the next succeeding day which is not a Saturday, Sunday or legal holiday.

Section 7. Intent of Contract Documents and Contractor Representations

A. It is the intent of the Contract Documents to describe a functionally complete project (or portion thereof) to be constructed in accordance with the Contract Documents. Any work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result shall be supplied whether or not specifically called for. When words which have a well known technical or trade meaning are used to describe work, materials or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association or to the laws or regulations of any governmental authority having jurisdiction over the Project, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, law or regulation in effect at the time the Work is performed, except as may be otherwise specifically stated herein.

1 The Liquidated Damages have been valued based upon the Florida Department of Transportation's Standard Specifications for Road and Bridge Construction, published **July 2017**.

B. If before or during the performance of the Work, Contractor discovers a conflict, error or discrepancy in the Contract Documents, Contractor immediately shall report same to Engineer in writing and before proceeding with the Work affected thereby shall obtain a written interpretation or clarification from the Engineer. Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to Contractor with the Contract Documents before commencing any portion of the Work.

C. Drawings are intended to show general arrangements, design and extent of Work and are not intended to serve as shop drawings. Specifications are separated into divisions for convenience of reference only and shall not be interpreted as establishing divisions for the Work, trades, subcontracts, or extent of any part of the Work. In the event of a discrepancy between or among the drawings, specifications or other Contract Document provisions, Contractor shall be required to comply with the provision which is the more restrictive or stringent requirement upon the Contractor, as determined by the Engineer.

D. In order to induce Owner to enter into this Agreement Contractor makes the following representations:

D.1 Contractor has examined and carefully studied the Contract Documents (including those listed in Section 4) and the other related data identified in the Project Documents including "technical data."

D.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.

D.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.

D.4 Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site. 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.

D.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.

D.6. Contractor has correlated the information known to Contractor, information and observation 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.

D.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.

Section 8. Investigation and Utilities

A. Contractor shall have the sole responsibility of satisfying itself concerning the nature and location of the Work and the general and local conditions, and particularly, but without limitation, with respect to the following: those affecting transportation, access, disposal, handling and storage of materials; availability and quality of labor; water and electric power; availability and condition of roads; work area; living facilities; climatic conditions and seasons; physical conditions at the work-site and the project area as a whole; topography and ground surface conditions; nature and quantity of the surface materials to be encountered; subsurface conditions; equipment and facilities needed preliminary to and during performance of the Work; and all other costs associated with such performance. The failure of Contractor to acquaint itself with any applicable conditions shall not relieve Contractor from any of its responsibilities to perform under the Contract Documents, nor shall it be considered the basis for any claim for additional time or compensation.

B. Contractor shall locate all existing roadways, railways, drainage facilities and utility services above, upon, or under the Project site, said roadways, railways, drainage facilities and utilities being referred to in this Sub-Section 8.B. as the "Utilities". Contractor shall contact the owners of all Utilities to determine the necessity for relocating or temporarily interrupting any Utilities during the construction of the Project. Contractor shall schedule and coordinate its Work around any such relocation or temporary service interruption. Contractor shall be responsible for properly shoring, supporting and protecting all Utilities at all times during the course of the Work.

Section 9. Schedule

A. The Contractor, within ten (10) calendar days after receipt of a Notice of Award, shall prepare and submit to the County and Engineer, for their review and approval, a progress schedule for the Project (herein "Progress Schedule"). The Progress Schedule shall relate to all Work required by the Contract Documents and shall: show the various activities of work in sufficient detail to demonstrate a reasonable and workable plan to complete the Project within the Contract Time; show the order and interdependence of activities and the sequence for accomplishing the Work and describe all activities in sufficient detail so that the Engineer can readily identify the work and measure the progress on of each activity; show each activity with a beginning work date, a duration, and a monetary value; include activities for procurement fabrication, and delivery of materials, plant, and equipment, and review time for shop drawings and submittals; include milestone activities when milestones are required by the Contract Documents; and in a Project with more than one phase, adequately identify each phase and its completion date, and not allow activities to span more than one phase. The Contractor shall also submit a working plan with the Progress Schedule, consisting of a concise written description of the construction plan.

B. The Engineer will return inadequate schedules to the Contractor for corrections and Contractor shall resubmit a corrected schedule within five (5) calendar days from the date of the Engineer's return transmittal. The Engineer will use the accepted Project Schedule as the baseline against which to measure the progress. However, by acceptance of the Project Schedule, the Engineer does not endorse or otherwise certify the validity or accuracy of the activity durations or sequencing of activities.

B. The Progress Schedule shall be updated by the Contractor if there is a significant change in the planned order or duration of an activity or upon the request of the Engineer, which shall not be requested more than [INSERT TIMES] a month. All updates to the Progress Schedule shall be subject to the County's and Engineer's review and approval. The Engineer's review and approval of submitted the Progress Schedule and any required or requested updates shall be a condition precedent to the County's obligation to pay the Contractor.

Section 10. Progress Payments

A. Prior to submitting its first Application for Payment, Contractor shall submit to the County and the Engineer, for their review and approval, a schedule of values based upon the Contract Price, listing the major elements of the Work and the dollar value for each element. After its approval by the County and Engineer, this schedule of values shall be used as the basis for the Contractor's monthly Applications for Payment. This schedule shall be updated and submitted each month to the Engineer along with a completed and notarized copy of the Application for Payment form.

B. Prior to submitting its first Application for Payment, Contractor shall submit to the Engineer a complete list of all its proposed subcontractors and materialmen. The first Application for Payment shall be submitted no earlier than thirty (30) days after the Commencement Date.

C. If payment is requested on the basis of materials and equipment not incorporated into the Project, but delivered and suitably stored at the site or at another location agreed to by the County in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice or other documentation warranting that the County has received the materials and equipment free and clear of all liens, charges, security interests and encumbrances, together with evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect the County's interest therein, all of which shall be subject to the County's satisfaction.

D. Contractor shall submit its monthly Application for Payment to the Engineer on or before the 25th day of each month for work performed during the previous month. Invoices received after the 25th day of each month shall be considered for payment as part of the next month's application. Within ten (10) calendar days after receipt of each Application for Payment, the Engineer shall either:

D.1 indicate his approval of the requested payment;

D.2 indicate his approval of only a portion of the requested payment, stating in writing his reasons therefore; or

D.3 return the Application for Payment to the Contractor indicating, in writing, the reason for refusing to approve payment.

In the event of a total denial and return of the Application for Payment by the Engineer, the Contractor may make the necessary corrections and resubmit the Application for Payment. The County shall, within thirty (30) calendar days after County approval of an Application for Payment, pay the Contractor the amounts so approved. Provided, however, in no event shall the County be obligated to pay any amount greater than that portion of the Application for Payment approved by the Engineer.

E. The County shall retain five percent (5%) of the gross amount of each monthly payment request or five percent (5%) of the portion thereof approved by the Engineer for payment, whichever is less. Such sums shall be accumulated and released to Contractor with final payment.

F. Monthly payments to Contractor shall in no way imply approval or acceptance of Contractor's work.

G. Each Application for Payment shall be accompanied by a Release and Affidavit, in the form attached to this Agreement, showing that all materials, labor, equipment and other bills associated with that portion of the Work for which payment is being requested have been paid in full. The County shall not be required to make payment until and unless these affidavits are furnished by the Contractor.

H. The County reserves the right to issue joint checks to Contractor and its material suppliers, subcontractors, labor unions, equipment suppliers, etc., if, in the County's sole judgment, it is necessary to do so to ensure payment to the above named parties or if above named parties have filed a notice of nonpayment, lien or intent to lien, stop notice, etc.

Section 11. Payments Withheld

A. The Engineer or the County may decline to approve any Application for Payment, or portions thereof, because of subsequently discovered evidence or subsequent inspections. The Engineer or the County may nullify the whole or any part of any approval for payment previously issued and the County may withhold any payments otherwise due Contractor under this Agreement or any other agreement between the County and Contractor, to such extent as may be necessary in the County's opinion to protect it from loss because of:

A.1 Defective Work not remedied;

A.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

A.3 Failure of Contractor to make payment properly to subcontractors or for labor, materials or equipment;

A.4 Reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount;

A.5 Reasonable indication that the Work will not be completed within the Contract Time;

A.6 Unsatisfactory prosecution of the Work by the Contractor;

A.7 Failure to provide accurate and current "As-Builts"; or

A.8 Any other material breach of the Contract Documents.

B. If these conditions in Subsection 11.A are not remedied or removed, the County may, after three (3) days written notice, rectify the same at Contractor's expense. The County also may offset against any sums due Contractor the amount of any liquidated or unliquidated obligations of Contractor to the County, whether relating to or arising out of this Agreement or any other agreement between Contractor and the County.

Section 12. Final Payment

A. The County shall make final payment to Contractor within thirty (30) calendar days after the Work is finally inspected and accepted by both the County and the Engineer in accordance with Section 25.B. herein, provided that Contractor first, and as an explicit condition precedent to the accrual of Contractor's right to final payment, shall have furnished the County with a properly executed and notarized copy of the Release and Affidavit, as well as, a duly executed copy of the Surety's consent to final payment and such other documentation that may be required by the Contract Documents and the County.

B. Contractor's acceptance of final payment shall constitute a full waiver of any and all claims by Contractor against the County arising out of this Agreement or otherwise relating to the Project, except those previously made in writing and identified by parties as unsettled at the time of the final Application for Payment. Neither the acceptance of the Work nor payment by the County shall be deemed to be a waiver of the County's right to enforce any obligations of Contractor hereunder or to the recovery of damages for defective Work not discovered by the Engineer or the County at the time of final inspection.

Section 13. Submittals and Substitutions

A. Contractor shall carefully examine the Contract Documents for all requirements for approval of materials to be submitted such as a schedule of values, safety manual, shop drawings, data, test results, schedules and samples. Contractor shall submit all such materials at its own expense and in such form as required by the Contract Documents in sufficient time to prevent any delay in the delivery of such materials and the installation thereof.

B. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other suppliers may be accepted by the County if sufficient information is submitted by Contractor to allow the County to determine that the material or equipment proposed is equivalent or better than to that named. Requests for review of substitute items of material and equipment will not be accepted by the County from anyone other than Contractor and all such requests must be submitted by Contractor to Engineer within thirty (30) calendar days after Notice of Award is received by Contractor.

C. If Contractor wishes to furnish or use a substitute item of material or equipment, Contractor shall make application to the Engineer for acceptance thereof, certifying that the proposed substitute shall perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application shall state that the evaluation and acceptance of the proposed substitute will not prejudice Contractor's achievement of substantial completion on time, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with the County for the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in

connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service shall be indicated. The application also shall contain an itemized estimate of all costs that will result, directly or indirectly, from acceptance of such substitute, including costs for redesign and claims of other contractors affected by the resulting change, all of which shall be considered by the Engineer in evaluating the proposed substitute. The Engineer may require Contractor to furnish at Contractor's expense additional data about the proposed substitute.

D. If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to the Engineer, if Contractor submits sufficient information to allow the Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents. The procedures for submission to and review by the Engineer shall be the same as those provided herein for substitute materials and equipment.

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

Section 14. Daily Reports, As-Builts and Meetings

A. Unless waived in writing by the County, Contractor shall complete, maintain, and submit to Engineer on a _____ basis a daily log of the Contractor's work in a format approved by the Engineer. The daily log shall document all activities of Contractor at the Project site including, but not limited to, the following:

A.1. Weather conditions showing the high and low temperatures during work hours, the amount of precipitation received on the Project site, and any other weather conditions which adversely affect the Work;

A.2. Any Conditions which adversely affect the Work;

A.3. The hours of operation by Contractor's and subcontractor's personnel;

A.4. The number of Contractor's and subcontractor's personnel present and working at the Project site, by subcontract and trade;

A5. All equipment present at the Project site, description of equipment use and designation of time equipment was used (specifically indicating any down time);

A.6. Description of Work being performed at the Project site;

A.7. Any unusual or special occurrences at the Project site;

A.8. Materials received at the Project site;

A.9. A list of all visitors to the Project site; and

A.10. Any problems that might impact either the cost or quality of the Work or the time of performance.

The daily log shall not constitute nor take the place of any notice required to be given by Contractor to the County or Engineer pursuant to the Contract Documents.

B. Contractor shall maintain in a safe place at the Project site one record copy of the Contract Documents, including, but not limited to, all drawings, specifications, addenda, amendments, Change Orders, Work Directive Changes and Field Orders, as well as all written interpretations and clarifications issued by the Engineer, in good order and annotated to show all changes made during construction. The annotated drawings shall be continuously updated by the Contractor throughout the prosecution of the Work to accurately reflect all field changes that are made to adapt the Work to field conditions, changes resulting from Change Orders, Work Directive Changes and Field Orders, and all concealed and buried installations of piping, conduit and utility services. All buried and concealed items, both inside and outside the Project site, shall be accurately located on the annotated drawings as to depth and in relationship to not less than two (2) permanent features (e.g. interior or exterior wall faces). The annotated drawings shall be clean and all changes, corrections and dimensions shall be given in a neat and legible manner in a contrasting color. The "As-Built" record documents, together with all approved samples and a counterpart of all approved shop drawings shall be available to Engineer for reference. Current and accurate “As-Built” record documents shall be submitted with each Application for Payment. Failure to provide current and accurate “As-Built” record drawings shall be reason for rejecting the Application for Payment. Upon completion of the Work and as a condition precedent to Contractor's entitlement to final payment, these "As-Built" record documents, samples and shop drawings shall be delivered to Engineer by Contractor for the County.

C. Contractor shall keep all records and supporting documentation which concern or relate to the Work hereunder for a minimum of five (5) years from the date of termination of this Agreement or the date the Project is completed, whichever is later. The County, or any duly authorized agents or representatives of the County, shall have the right to audit, inspect and copy all such records and documentation as often as they deem necessary during the period of this Agreement

and during the five (5) year period noted above; provided, however, such activity shall be conducted only during normal business hours.

D. In addition to other requirements provided herein, Contractor shall:

D.1. Keep and maintain public records that ordinarily and necessarily would be required by the County in order to perform the Work.

D.2. Provide the public with access to public records on the same terms and conditions that the County would provide the records and at a cost that does not exceed the cost provided in this chapter or as otherwise provided by law.

D.3. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law.

D.4. Meet all requirements for retaining public records and transfer, at no cost, to the County all public records in possession of the Contractor upon termination of the Contract and destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. All records stored electronically must be provided to the County in a format that is compatible with the information technology systems of the County.

D.5. If the Contractor does not comply with a public records request, the County may terminate this Contract in accordance with Section 23 hereof.

Section 15. Independent Contractor

Contractor is an independent contractor and shall, at its sole cost and expenses and without increase in the contract price, comply with all laws, rules, ordinances, and regulations of all governing bodies having jurisdiction over the Work. Contractor shall be responsible for securing timely inspections and approvals of its work from all such authorities and as required by the Contract Documents. Contractor shall obtain and pay for all necessary permits and licenses, including business licenses; pay all fees, manufacturer's taxes, sales taxes, use taxes, processing taxes, and all federal and state taxes, insurance and contributions for social security and unemployment or disability insurance, which are measured by wages, salaries, or other remunerations paid to Contractor's employees, whether levied under existing or subsequently enacted laws, rules, or regulations. Contractor shall maintain proof that it has complied with all aspects of the foregoing provision and shall make such proof available for review by the County at County's request.

Section 16. Contractor Performance, Extensions, and No Damages for Delay of Work

A. Contractor shall diligently pursue the completion of the Work and coordinate the Work being done on the Project by its subcontractors and materialmen, as well as coordinating its Work with all work of others at the Project Site, so that its Work or the work of others shall not be delayed or impaired by any act or omission by Contractor. Contractor shall be solely responsible for

all construction means, methods, techniques, sequences, and procedures, as well as coordination of all portions of the Work under the Contract Documents.

B. Should Contractor be obstructed or delayed in the prosecution of or completion of the Work as a result of unforeseeable causes beyond the control of Contractor, and not due to its fault or neglect, including but not restricted to acts of God or of the public enemy, acts of government, fires, floods, epidemics, quarantine regulation, strikes or lockouts, Contractor shall notify the County in writing within forty-eight (48) hours after the commencement of such delay, stating the cause or causes thereof, or be deemed to have waived any right which Contractor may have had to request a time extension.

C. No interruption, interference, inefficiency, suspension or delay in the commencement or progress of the Work from any cause whatever, including those for which the County may be responsible, in whole or in part, shall relieve Contractor of his duty to perform or give rise to any right to damages or additional compensation from the County. Contractor expressly acknowledges and agrees that it shall receive no damages for delay. Contractor's sole remedy, if any, against the County will be the right to seek an extension to the Contract Time; provided, however, the granting of any such time extension shall not be a condition precedent to the aforementioned "No Damage For Delay" provision. This paragraph shall expressly apply to claims for early completion, as well as to claims based on late completion.

Section 17. Changes in the Work

A. The County shall have the right at any time during the progress of the Work to increase or decrease the Work. Promptly after being notified of a change, Contractor shall submit an itemized estimate of any cost or time increases or savings it foresees as a result of the change. Except in an emergency endangering life or property, or as expressly set forth herein, no addition or changes to the Work shall be made except upon written order of the County, and the County shall not be liable to the Contractor for any increased compensation without such written order. No officer, employee or agent of the County is authorized to direct any extra or changed work orally.

B. A Change Order, in the form attached to this Agreement, shall be issued and executed promptly after an agreement is reached between Contractor and the County concerning the requested changes. Contractor shall promptly perform changes authorized by duly executed Change Orders. The Contract Amount and Contract Time shall be adjusted in the Change Order in the manner as the County and Contractor shall mutually agree.

C. If the County and Contractor are unable to agree on a Change Order for the requested change, Contractor shall, nevertheless, promptly perform the change as directed by the County in a written Work Directive Change. In that event, the Contract Amount and Contract Time shall be adjusted as directed by the County. If Contractor disagrees with the County's adjustment determination, Contractor must make a claim pursuant to Section 18 of this Agreement or else be deemed to have waived any claim on this matter it might otherwise have had.

D. In the event a requested change results in an increase to the Contract Amount, the amount of the increase shall be limited to the Contractor's reasonable direct labor and material costs and reasonable actual equipment costs as a result of the change (including allowance for labor burden costs) plus a maximum ten percent (10%) markup for all overhead and profit. In the event such change Work is performed by a Subcontractor, a maximum ten percent (10%) markup for all overhead and profit for all Subcontractors' and sub-subcontractors' direct labor and material costs and actual equipment costs shall be permitted, with a maximum five percent (5%) markup thereon by the Contractor for all of its overhead and profit, for a total maximum markup of fifteen percent (15%). All compensation due Contractor and any Subcontractor or sub-subcontractor for field and home office overhead is included in the markups noted above.

E. The County shall have the right to conduct an audit of Contractor's books and records to verify the accuracy of the Contractor's claim with respect to Contractor's costs associated with any Change Order.

F. The Engineer shall have authority to order minor changes in the Work not involving an adjustment to the Contract Amount or an extension to the Contract Time exceeding his/her authority and not inconsistent with the intent of the Contract Documents. Minor changes approved by the Engineer, whether changes to Work and or Contract Time, cumulatively may not exceed ten percent (10%) of the Work and or Original Contract Time. Such changes may be effected by Field Order or by other written order. Such changes shall be binding on the Contractor.

Section 18. Claims and Disputes

A. A Claim is a demand or assertion by one of the parties seeking an adjustment or interpretation of the terms of the Contract Documents, payment of money, extension of time or other relief with respect to the terms of the Contract Documents. The term "Claim" also includes other disputes and matters in question between the County and Contractor arising out of or relating to the Contract Documents. The responsibility to substantiate a Claim shall rest with the party making the Claim.

B. Claims by the Contractor shall be made in writing to the Engineer within forty-eight (48) hours after the first day of the event giving rise to such Claim or else the Contractor shall be deemed to have waived the Claim. Written supporting data shall be submitted to the Engineer within fifteen (15) calendar days after the occurrence of the event, unless the County grants additional time in writing, or else the Contractor shall be deemed to have waived the Claim. All claims shall be priced in accordance with the provisions of Subsection 17.D. Engineer will render a formal decision on the claim in writing within fifteen (15) calendar days after receipt of the Contractor’s Claim. Engineer’s written decision will be final and binding upon Contractor and unless Contractor submits a written notice to the County and Engineer requesting non-binding voluntary mediation within fifteen (15) calendar days of the date of such decisions, then Contractor forever waives and relinquishes any rights to bring any future legal actions or court claims with respect to such Claim.

Non-binding Mediation shall be completed within sixty (60) days from the date of Contractor's timely submission of a written notice requesting non-binding voluntary mediation.

C. The Contractor shall proceed diligently with its performance as directed by the County, regardless of any pending Claim, action, suit or administrative proceeding, unless otherwise agreed to by the County in writing. The County shall continue to make payments in accordance with the Contract Documents during the pendency of any Claim.

Section 19. Indemnification and Insurance

A. To the fullest extent permitted by law, Contractor and its surety covenant and agree to indemnify and hold County harmless of and from any and all claims, losses, demands, causes of action and the like, including but not limited to, attorneys' fees and court costs which may be asserted against County by anyone other than Contractor, resulting from, arising out of, or occurring in connection with the failure of Contractor or supplier of Contractor to perform all work required within the scope of this agreement in strict accordance with the contract documents.

B. To the full extent permitted by law, Contractor hereby agrees to defend and indemnify, protect and hold harmless County, its agents, employees, servants and sureties (individually the "Indemnified Party" and collectively the "Indemnified Parties") of and from any loss or damage and to reimburse the Indemnified Parties for any and all expenses, including legal fees, expert witness fees and other litigation costs to which the Indemnified Parties may be put because of:

B.1. the liability for claims and liens for labor performed or materials used or furnished through or under Contractor for the project for which Contractor is liable due to any failure of Contractor to adhere to the terms of this agreement or any of the contract documents;

B.2. liability to County resulting from Contractor's failure to comply with applicable licensing requirements;

B.3. any personal injury, loss, damage or death to any person or persons (including employees, officers or agents of County, Contractor and lower tier subcontractors) and any property damage arising out of, result from, or in connection with the performance or non performance of work required in this contract or by reason of any act, omission, fault or negligence whether active or passive of Contractor whether on the project or proceeding to or from the site, including, without limitation, any personal injury, loss, damage, death or property damage caused (or alleged to be caused) by any negligent or grossly negligent act, error or omission of any person or entity, including any Indemnified Party whether such Indemnified Party's or the person's or

entity's negligence be joint or concurrent however, Contractor shall not be required to indemnify an Indemnified Party for that party's sole negligence; or

B.4. liability imposed upon County directly or indirectly by Contractor's failure or the failure of any of its employees to comply with any law, ordinance, rule, regulation or requirement, including, but not limited to, any Occupational Safety and Health Administration violations and any penalties, including enhancements, resulting in whole or in part by subcontractor's acts or omissions as well as the Immigration Reform and Control Act of 1986 and all rules and regulations adopted pursuant thereto.

C. To the fullest extent permitted by law, in addition to the express duty to indemnify County when there is any causal connection between Contractor's work and any injury, loss, damage, death or property damage, Contractor expressly undertakes a duty to defend County as a separate duty, independent of and broader than the duty to indemnify. The duty to defend agreed to by Contractor hereby expressly include all costs of litigation, attorney's fees, settlement costs and reasonable expenses in connection with the litigation, whether or not the claims made for loss, injury, damage or property damage are valid or groundless and regardless of whether the defense of County is maintained by the County or assumed by Contractor as long as the claims made could be causally connected to Contractor as reasonable determined by County (claims).

D. The County and Contractor agree the first $100.00 of the Contract Amount paid by the County to Contractor shall be given as separate consideration for this indemnification and duty to defend, and any other indemnification of the County by Contractor provided for within the Contract Documents, the sufficiency of such separate consideration being acknowledged by Contractor by Contractor's execution of the Agreement. The Contractor's obligation under this provision shall not be limited in any way by the agreed upon contract price as shown in this contract or the Contractor's limit of, or lack of, sufficient insurance protection.

E. Contractor shall obtain and carry, at all times during its performance under the Contract Documents, insurance of the types and in the amounts set forth in the Insurance Requirements attached to this Agreement. All insurance policies shall be from responsible companies duly authorized to do business in the State of Florida and/or responsible risk retention group insurance companies which are registered with the State of Florida. Within fifteen (15) calendar days after Notice of Award is received by Contractor, Contractor shall provide the County with properly executed Certificates of Insurance to evidence Contractor's compliance with the insurance requirements of the Contract Documents. Said Certificates of Insurance shall be on forms approved by the County. The Certificates of Insurance shall be personally, manually signed by the authorized representatives of the insurance company/companies shown on the Certificates of Insurance, with proof that they are authorized representatives thereof. In addition, certified, true and exact copies of all insurance polices required hereunder shall be provided to the County, on a timely basis, when requested by the County.

F. The Certificates of Insurance and required insurance policies shall contain provisions that thirty (30) days prior written notice by registered or certified mail shall be given the County of any cancellation, intent not to renew, or reduction in the policies or coverages, except in the application of the aggregate limits provisions. In the event of a reduction in the aggregate limit of any policy, Contractor shall immediately take steps to have the aggregate limit reinstated to the full extent permitted under such policy.

G. All insurance coverages of the Contractor shall be primary to any insurance or self insurance program carried by the County applicable to this Project. The acceptance by the County of any Certificate of Insurance does not constitute approval or agreement by the County that the insurance requirements have been satisfied or that the insurance policy shown on the Certificate of Insurance is in compliance with the requirements of the Contract Documents. No work shall commence at the Project site unless and until the required Certificates of Insurance are received by the County.

H. Contractor shall require each of its subcontractors to procure and maintain, until the completion of the subcontractor's work, insurance of the types and to the limits specified in the Insurance Requirements attached to this Agreement, unless such insurance requirements for the subcontractor is expressly waived in writing by the County. All liability insurance policies, other than professional liability, worker's compensation, employer's liability and business auto liability policies, obtained by Contractor to meet the requirements of the Contract Documents shall name the County and Engineer as additional insureds and shall contain severability of interest provisions. If any insurance provided pursuant to the Contract Documents expires prior to the completion of the Work, renewal Certificates of Insurance and, if requested by the County, certified, true copies of the renewal policies, shall be furnished by Contractor within thirty (30) days prior to the date of expiration.

I. Should at any time the Contractor not maintain the insurance coverages required herein, the County may terminate the Agreement or at its sole discretion shall be authorized to purchase such coverages and charge the Contractor for such coverages purchased. The County shall be under no obligation to purchase such insurance, nor shall it be responsible for the coverages purchased or the insurance company or companies used. The decision of the County to purchase such insurance coverages shall in no way be construed to be a waiver of any of its rights under the Contract Documents.

J. Contractor shall submit to Engineer a copy of all accident reports arising out of any injuries to its employees or those of any firm or individual to whom it may have subcontracted a portion of the Work, or any personal injuries or property damages arising or alleged to have arisen on account of any work by Contractor under the Contract Documents.

Section 20. Compliance with Laws

Contractor agrees to comply, at its own expense, with all federal, state and local laws, codes, statutes, ordinances, rules, regulations and requirements applicable to the Project, including but not

limited to those dealing with taxation, worker's compensation, equal employment and safety. If Contractor observes that the Contract Documents are at variance therewith, it shall promptly notify the County and Engineer in writing.

Section 21. Cleanup and Protections

A. Contractor agrees to keep the Project site clean at all times of debris, rubbish and waste materials arising out of the Work. At the completion of the Work, Contractor shall remove all debris, rubbish and waste materials from and about the Project site, as well as all tools, appliances, construction equipment and machinery and surplus materials, and shall leave the Project site clean and ready for occupancy by the County.

B. Any existing surface or subsurface improvements, including, but not limited to, pavements, curbs, sidewalks, pipes, utilities, footings, structures, trees and shrubbery, not indicated in the Contract Documents to be removed or altered, shall be protected by Contractor from damage during the prosecution of the Work. Any such improvements so damaged shall be restored by Contractor to the condition equal to that existing at the time of Contractor's commencement of the Work.

Section 22. Assignment

Contractor shall not assign this Agreement or any part thereof, without the prior consent in writing of the County. If Contractor does, with approval, assign this Agreement or any part thereof, it shall require that its assignee be bound to it and to assume toward Contractor all of the obligations and responsibilities that Contractor has assumed toward the County.

Section 23. Permits, Licenses and Taxes

A. Pursuant to Section 218.80, F.S., the County will pay for all County permits and fees, including license fees, permit fees, impact fees or inspection fees applicable to the work. Contractor is not responsible for paying for permits issued by the County wherein the work is to be performed, but is responsible for acquiring all permits. The County may require the Contractor to deliver internal budget transfer documents to applicable County agencies when the Contractor is acquiring permits.

B. All permits, fees and licenses necessary for the prosecution of the Work which are not issued by the County shall be acquired and paid for by the Contractor.

C. Contractor shall pay any and all sales, use, or other taxes, assessments and other similar charges when due, as required by any local, state of federal law, as it pertains to the services provided herein. Contractor further agrees that it shall protect, reimburse, and indemnify the County from and assume all liability for its tax obligations under the terms of this Agreement.

Section 24. Termination for Default

A. Contractor shall be considered in material default of the Agreement and such default shall be considered cause for the County to terminate the Agreement, in whole or in part, as further set forth in this Section, if Contractor: (1) fails to begin the Work under the Contract Documents within the time specified herein; or (2) fails to properly and timely perform the Work as directed by the County or the Engineer or as provided for in the approved Progress Schedule; or (3) performs the Work unsuitably or neglects or refuses to remove materials or to correct or replace such Work as may be rejected as unacceptable or unsuitable; or (4) discontinues the prosecution of the Work; or (5) fails to resume Work which has been suspended within a reasonable time after being notified to do so; or (6) becomes insolvent or is declared bankrupt, or commits any act of bankruptcy; or (7) allows any final judgment to stand against it unsatisfied for more than ten (10) days; or (8) makes an assignment for the benefit of creditors; or (9) fails to obey any applicable codes, laws, ordinances, rules or regulations with respect to the Work; or (10) materially breaches any other provision of the Contract Documents.

B. The County shall notify Contractor in writing of Contractor's default(s). If the County determines that Contractor has not remedied and cured the default(s) within seven (7) calendar days following receipt by Contractor of said written notice, then the County, at its option, without releasing or waiving its rights and remedies against the Contractor's sureties and without prejudice to any other right or remedy it may be entitled to hereunder or by law, may terminate Contractor's right to proceed under the Agreement, in whole or in part, and take possession of all or any portion of the Work and any materials, tools, equipment, and appliances of Contractor, take assignments of any of Contractor's subcontracts and purchase orders, and complete all or any portion of Contractor's Work by whatever means, method or agency which the County, in its sole discretion, may choose.

C. If the County deems any of the foregoing remedies necessary, Contractor agrees that it shall not be entitled to receive any further payments hereunder until after the Project is completed. All monies expended and all of the costs, losses, damages and extra expenses, including all management, administrative and other overhead and other direct and indirect expenses (including Engineer and attorneys' fees) or damages incurred by the County incident to such completion, shall be deducted from the Contract Amount, and if such expenditures exceed the unpaid balance of the Contract Amount, Contractor agrees to pay promptly to the County on demand the full amount of such excess, including costs of collection, attorney's fees (including appeals) and interest thereon at the maximum legal rate of interest until paid. If the unpaid balance of the Contract Amount exceeds all such costs, expenditures and damages incurred by the County to complete the Work, such excess shall be paid to the Contractor. The amount to be paid to the Contractor or the County, as the case may be, shall be approved by the Engineer, upon application, and this obligation for payment shall survive termination of the Agreement.

D. The liability of Contractor hereunder shall extend to and include the full amount of any and all sums paid, expenses and losses incurred, damages sustained, and obligations assumed by the County in good faith under the belief that such payments or assumptions were necessary or required, in completing the Work and providing labor, materials, equipment, supplies, and other

items therefore or re-letting the Work, and in settlement, discharge or compromise of any claims, demands, suits, and judgments pertaining to or arising out of the Work hereunder.

E. If, after notice of termination of Contractor's right to proceed pursuant to this Section, it is determined for any reason that Contractor was not in default, or that its default was excusable, or that the County is not entitled to the remedies against Contractor provided herein, then Contractor's remedies against the County shall be the same as and limited to those afforded Contractor under Section 24 below.

Section 24. Termination for Convenience and Right of Suspension

A. The County shall have the right to terminate this Agreement without cause upon seven (7) calendar days written notice to Contractor. In the event of such termination for convenience, Contractor's recovery against the County shall be limited to that portion of the Contract Amount earned through the date of termination, together with any retainage withheld and reasonable termination expenses incurred, but Contractor shall not be entitled to any other or further recovery against the County, including, but not limited to, damages or any anticipated profit on portions of the Work not performed.

B. The County shall have the right to suspend all or any portions of the Work upon giving Contractor not less than two (2) calendar days' prior written notice of such suspension. If all or any portion of the Work is so suspended, Contractor's sole and exclusive remedy shall be to seek an extension of time to its schedule in accordance with the procedures set forth in the Contract Documents. In no event shall the Contractor be entitled to any additional compensation or damages. Provided, however, if the ordered suspension exceeds six (6) months, the Contractor shall have the right to terminate the Agreement with respect to that portion of the Work which is subject to the ordered suspension.

Section 25. Completion

A. When the entire Work (or any portion thereof designated in writing by the County) is ready for its intended use, Contractor shall notify the Engineer in writing that the entire Work (or such designated portion) is substantially complete and request that Engineer issue a Certificate of Substantial Completion (or Certificate of Partial Substantial Completion). Within a reasonable time thereafter, the Contractor and Engineer shall make an inspection of the Work (or designated portion thereof) to determine the status of completion. If the Engineer does not consider the Work (or designated portion) substantially complete, Engineer shall notify Contractor in writing giving the reasons therefor. If the Engineer considers the Work (or designated portion) substantially complete, Engineer shall prepare and deliver to Contractor a Certificate of Substantial Completion (or Certificate of Partial Substantial Completion) which shall fix the date of Substantial Completion for the entire Work (or designated portion thereof) and include a tentative punchlist of items to be completed or corrected by Contractor before final payment. The County shall have the right to exclude Contractor from the Work and Project site (or designated portion thereof) after the date of

Substantial Completion, but the County shall allow Contractor reasonable access to complete or correct items on the tentative punchlist.

B. Upon receipt of written certification by Contractor that the Work is completed in accordance with the Contract Documents and is ready for final inspection and acceptance and upon receipt of a final Application for Payment, Engineer will make such inspection and, if he finds the Work acceptable and fully performed under the Contract Documents, he shall promptly issue a final Certificate for Payment, recommending that, on the basis of his observations and inspections, and the Contractor's certification that the Work has been completed in accordance with the terms and conditions of the Contract Documents, that the entire balance found to be due Contractor is due and payable. Neither the final payment nor the retainage shall become due and payable until Contractor submits: (1) the Release and Affidavit in the form attached, (2) consent of surety to final payment, and (3) if required by the County, other data establishing payment or satisfaction of all obligations, such as receipts, releases and waivers of liens, arising out of the Contract Documents, to the extent and in such form as may be designated by the County. The County reserves the right to inspect the Work and make an independent determination as to the Work's acceptability, even though the Engineer may have issued his recommendations. Unless and until the County is completely satisfied, neither the final payment nor the retainage shall become due and payable.

Section 26. Warranty

Contractor shall obtain and assign to the County all express warranties given to Contractor or any subcontractors by any materialmen supplying materials, equipment or fixtures to be incorporated into the Project. Contractor warrants to the County that any materials and equipment furnished under the Contract Documents shall be new unless otherwise specified, and that all Work shall be of good quality, free from all defects and in conformance with the Contract Documents. Contractor further warrants to the County that all materials and equipment furnished under the Contract Documents shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturers, fabricators, suppliers or processors except as otherwise provided for in the Contract Documents. If, within one (1) year after final completion, any Work is found to be defective or not in conformance with the Contract Documents, Contractor shall correct it promptly after receipt of written notice from the County. Contractor shall also be responsible for and pay for replacement or repair of adjacent materials or Work which may be damaged as a result of such replacement or repair. These warranties are in addition to those implied warranties to which the County is entitled as a matter of law.

Section 27. Tests and Inspections.

A. The County, Engineer, their respective representatives, agents and employees, and governmental agencies with jurisdiction over the Project shall have access at all times to the Work, whether the Work is being performed on or off of the Project site, for their observation, inspection and testing. Contractor shall provide proper, safe conditions for such access. Contractor shall provide Engineer with timely notice of readiness of the Work for all required inspections, tests or approvals.

B. If the Contract Documents or any codes, laws, ordinances, rules or regulations of any public authority having jurisdiction over the Project requires any portion of the Work to be specifically inspected, tested or approved, Contractor shall assume full responsibility therefore, pay all costs in connection therewith and furnish Engineer the required certificates of inspection, testing or approval. All inspections, tests or approvals shall be performed in a manner and by organizations acceptable to the Engineer and the County.

C. If any Work that is to be inspected, tested or approved is covered without written concurrence from the Engineer, such work must, if requested by Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness to respond to such notice. If any Work is covered contrary to written directions from Engineer, such Work must, if requested by Engineer, be uncovered for Engineer's observation and be replaced at Contractor's sole expense.

D. The County shall charge to Contractor and may deduct from any payments due Contractor all engineering and inspection expenses incurred by the County in connection with any overtime work. Such overtime work consisting of any work during the construction period beyond the regular eight (8) hour day and for any work performed on Saturday, Sunday or holidays.

E. Neither observations nor other actions by the Engineer nor inspections, tests or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

Section 28. Defective Work

A. Work not conforming to the requirements of the Contract Documents shall be deemed defective Work. If required by the County or Engineer, Contractor shall, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or if the defective Work has been rejected by the County or Engineer, remove it from the site and replace it with conforming Work. Contractor shall bear all direct, indirect and consequential costs of such correction or removal (including, but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby, and shall hold the County harmless for same.

B. If any portion of the Work is defective, or Contractor fails to supply sufficient skilled workers with suitable materials or equipment, or fails to finish or perform the Work in such a way that the completed Work will conform to the Contract Documents, the County or Engineer may order Contractor to stop the Work, or any portion thereof, until the cause for such stop in the work has been eliminated; however, this right of the County or Engineer to stop the Work shall not give rise to any duty on the part of the County or Engineer to exercise this right for the benefit of Contractor or any other party.

C. If Contractor fails, within a reasonable time after the written notice from the County or Engineer, to correct defective Work or to remove and replace rejected defective Work as required by Engineer or the County, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any of the provisions of the Contract Documents, the County may, after seven (7) days written notice to Contractor, correct and remedy any such deficiency.

Section 29. Supervision and Superintendents

Contractor shall plan, organize, supervise, schedule, monitor, direct and control the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents. Contractor shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without prior written notice to the County and Engineer except under extraordinary circumstances. The superintendent shall be Contractor's representative at the Project site and shall have authority to act on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor.

Section 30. Protection of Work

Contractor shall fully protect the Work from loss or damage and shall bear the cost of any such loss or damage until final payment has been made. If Contractor or any one for whom Contractor is legally liable is responsible for any loss or damage to the Work, or other work or materials of the County or the County's separate contractors, Contractor shall be charged with the same, and any monies necessary to replace such loss or damage shall be deducted from any amounts due Contractor.

Section 31. Emergencies

In the event of an emergency affecting the safety or protection of persons or the Work or property at the Project site or adjacent thereto, Contractor, without special instruction or authorization from the County or Engineer is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Engineer written notice within forty-eight (48) hours after the occurrence of the emergency, if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If the Engineer determines that a change in the Contract Documents is required because of the action taken in response to an emergency, a Change Order shall be issued to document the consequences of the changes or variations. If Contractor fails to provide the forty-eight (48) hour written notice noted above, the Contractor shall be deemed to have waived any right it otherwise may have had to seek an adjustment to the Contract Amount or an extension to the Contract Time.

Section 32. Use of Premises

Contractor shall confine all construction equipment, the storage of materials and equipment and the operations of workers to the Project site and land and areas identified in and permitted by the Contract Documents and other lands and areas permitted by law, rights of way, permits and easements, and shall not unreasonably encumber the Project site with construction equipment or other material or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or any land or areas contiguous thereto, resulting from the performance of the Work.

Section 33. Safety

A. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

A.1. All employees on the Work and other persons and/or organizations who may be affected thereby;

A.2. All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Project site; and

A.3. Other property on Project site or adjacent thereto, including trees, shrubs, walks, pavements, roadways, structures, utilities and any underground structures or improvements not designated for removal, relocation or replacement in the Contract Documents.

B. Contractor shall comply with all applicable codes, laws, ordinances, rules and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of underground structures and improvements and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation or replacement of their property. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as the Work is completed and final acceptance of same by the County has occurred.

C. Contractor shall designate a responsible representative at the Project site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to the County.

Section 34. Project Meetings

Prior to the commencement of Work, the Contractor shall attend a preconstruction conference with the Engineer and others as appropriate to discuss the Progress Schedule, procedures for handling shop drawings and other submittals, and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work. During the prosecution of the Work, the Contractor shall attend any and all meetings convened by the Engineer or the County with respect to the Project, when directed to do so by the County or Engineer. Contractor shall have its subcontractors and suppliers attend all such meetings (including the preconstruction conference) as may be directed by the County or Engineer.

Section 35. Notices

A. All notices required or made pursuant to this Agreement by the Contractor to the County or Engineer shall be in writing and delivered by hand or by United States Postal Service Department, first class mail, postage pre-paid, return receipt requested, or by Federal Express, addressed to the following:

County

David Kraus, Columbia County Administrator
135 NE Hernando Avenue, Suite 203
Lake City, Florida 32056-1529

and

Engineer

_____
_____
_____
_____

With courtesy copies also provided to:

Joel F. Foreman, County Attorney
Columbia County, Florida
207 S. Marion Avenue
Lake City, Florida 32025

Kevin Kirby, Public Works Director
Columbia County, Florida
Post Office Box 969
Lake City, Florida 32056-0969

Chad Williams, County Engineer
Columbia County Engineering Department
Post Office Box 1529
Lake City, Florida 32056

B. All notices required or made pursuant to this Agreement by the County to Contractor shall be made in writing and shall be delivered by hand or by United States Postal Service Department, first class mail, postage pre-paid, return receipt requested, or by Federal Express, addressed to the following:

Corporate Name of Contractor: _____

Address (including city, state and zip): _____

_____

Name of person with their title to whose

Attention the notice should be sent: _____

Telephone and Fax numbers: _____

C. Either party may change its above noted address by giving written notice to the other party in accordance with the requirements of this Section.

Section 36. Modification

No modification or change to the Agreement shall be valid or binding upon the parties unless in writing and executed by the party or parties intended to be bound by it.

Section 37. Successors and Assigns

Subject to other provisions hereof, the Agreement shall be binding upon and shall inure to the benefit of the successors and assigns of the parties to the Agreement.

Section 38. Governing Law

The Agreement shall be interpreted under and its performance governed by the laws of the State of Florida.

Section 39. Venue

The state courts in and for Columbia County, Florida shall be the proper and sole venue for any legal action on any and all claims, disputes or other matters in controversy arising out of or relating to this Agreement, whether stated as contractual, tort, equitable, statutory or any other claims or causes of action.

Section 40. No Waiver

The failure of the County to enforce at any time or for any period of time any one or more of the provisions of the Agreement shall not be construed to be and shall not be a waiver of any such provision or provisions or of its right thereafter to enforce each and every such provision.

Section 41. Remedies Cumulative

No right or remedy in this Agreement is intended to be exclusive of any other right or remedy, but every such right or remedy shall be cumulative and shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

Section 42. Entire Agreement

Each of the parties hereto agrees and represents that the Agreement comprises the full and entire agreement between the parties affecting the Work contemplated, and no other agreement or understanding of any nature concerning the same has been entered into or will be recognized, and that all negotiations, acts, work performed, or payments made prior to the execution hereof shall be deemed merged in, integrated and superseded by the Agreement.

Section 43. Severability

Should any provision of the Agreement be determined by a court to be unenforceable, such a determination shall not affect the validity or enforceability of any other section or part thereof.

Section 44. Third Party Beneficiaries

It is specifically agreed between the parties executing this Agreement that it is not intended by any of the provisions of any part of the Agreement to create in the public or any member thereof, a third party beneficiary under this Agreement, or to authorize anyone not a party to this Agreement to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of this Agreement.

Section 45. Public Records

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS CONTRACT, CONTACT THE CUSTODIAN OF PUBLIC RECORDS AT (INSERT TELEPHONE NUMBER, E-MAIL ADDRESS, AND MAILING ADDRESS).

Contractor must comply with the public records laws, Florida Statute chapter 119, specifically Contractor must:

A. Keep and maintain public records required by the County to perform the service.
B. Upon request from the County's custodian of public records, provide the County with a copy of the requested records or allow the records to be inspected or copied within a reasonable

time at a cost that does not exceed the cost provided in chapter 119 Florida Statutes or as otherwise provided by law.

C. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the contractor does not transfer the records to the County.

D. Upon completion of the contract, transfer, at no cost, to the County all public records in possession of the contractor or keep and maintain public records required by the County to perform the service. If the contractor transfers all public records to the public agency upon completion of the contract, the contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the contractor keeps and maintains public records upon completion of the contract, the contractor shall meet all applicable requirements for retaining the public records. All records stored electronically must be provided to the public agency, upon the request from the public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

IN WITNESS WHEREOF, the parties have executed this Agreement on the date(s) indicated below.

CONTRACTOR: _____
(Company Name)

ATTEST:

By:_____ (Signature) _____ (Printed)
Its: _____ (Title)
Date: _____

Witness:

Its:_____
President/Corporate Secretary/Witness Date:_____
[Corporate Seal]

_____
2nd Witness (if not incorporated)

OWNER: Board of County Commissioners of Columbia County, Florida

(SEAL) By:_____
Chairman

Clerk: _____ Date:_____

_____
Approved as to Form and Content:

_____
County Attorney

EXHIBIT A
LEGAL ADVERTISEMENT

EXHIBIT B
INVITATION TO BID

EXHIBIT C
BID PROPOSAL WITH REQUIRED FORMS

EXHIBIT D
PERFORMANCE BOND

BOND NO._____

KNOW ALL MEN BY THESE PRESENTS: That _____
_____, as Principal, whose principal business address is
_____
and phone number is _____, and
_____, as Surety, whose principal
address is_____
_____
and phone number is: _____ are
held and firmly bound to Columbia County, Florida (the "COUNTY"), as Obligee in the sum
of:_____
_____
($_____) for the payment whereof we bond ourselves, our heirs, executors, personal representatives, successors and assigns, jointly and severally.

WHEREAS, Principal has entered into a contract dated as of the _____ day of _____, 20____, with Obligee for _____
_____
_____
_____ COLUMBIA COUNTY Project No.:_____ in accordance with drawings and specifications, which contract is incorporated by reference and made a part hereof, and is referred to as the Contract.

THE CONDITION OF THIS BOND is that if Principal:

1. Performs the Contract at the times and in the manner prescribed in the Contract; and

2. Pays Obligee any and all losses, damages, costs and attorneys' fees, including appellate proceedings, that Obligee sustains because of any default by Principal under the Contract, including, but not limited to, all delay damages, whether liquidated or actual, incurred by Obligee; and

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

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

The Surety, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or other work to be performed hereunder, or the specifications referred to therein shall in anywise affect its obligations under this bond, and it does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to work or to the specifications.

This bond is intended to comply with provisions of Section 255.05, Florida Statutes, and all terms and conditions of said statute are incorporated herein by reference thereto, specifically including but not limited to the notice and time limitation provisions of said section. In the event of any conflict, ambiguity or discrepancy between Section 255.05, Florida Statutes, and this Bond, Florida Statutes shall control. No right of action shall accrue on this Bond to or, for the use of any person or entity other than the COUNTY and those persons or corporations provided for by said statute, their heirs, executors, administrators, successors or assigns.

It is further agreed and understood that if the COUNTY is required to initiate legal proceedings to recover on this Bond, the COUNTY may also recover its costs relating there to, including a reasonable amount for its attorney's fees and legal assistant's fees before trial, at trial, on appeal and in bankruptcy.

IN WITNESS WHEREOF, the above parties have executed this instrument this _____ day of _____, 20____, the name of each party being affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Signed, sealed and delivered
in the presence of:

PRINCIPAL: _____
(Company Name of Contractor)

By:_____(Officers Signature)
_____ (Officers Name Printed)

Witnesses as to Principal Name:_____ (Signature)
Its:_____ (Title)

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____day of _____, 20 _____, by _____(officer's name), as _____ (title) of _____ (company name), a(n)_____ (state) corporation, on behalf of the corporation. He/she is personally known to me OR has produced _____ as identification and did (did not) take an oath.

My Commission Expires: _____

Signature of Notary :_____
(Legibly Printed) _____

(AFFIX OFFICIAL SEAL) Notary Public, State of_____

Commission No. _____

ATTEST: SURETY:

_____
(Printed Company Name)

_____

_____
(Business Address)

_____ _____
(Surety Authorized Signature) (Printed Name)

Witness as to Surety _____(Signature)
_____(Printed Name)

OR

_____ _____
As Attorney in Fact (Signature) (Printed Name)

(Attach Power of Attorney)

Witnessed by: _____ _____
(Signature) (Printed Name)

_____ _____
(Business Address) (Telephone Number)

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____day of _____, 20____, by_____ (officer's name), as_____ (title) of _____ Surety, on behalf of Surety. He/She is personally known to me OR has produced _____ as identification and who did (did not) take an oath.

My Commission Expires: _____

Signature of Notary :_____
(Legibly Printed) _____

(AFFIX OFFICIAL SEAL) Notary Public, State of_____

Commission No. _____

EXHIBIT E
PUBLIC PAYMENT BOND

BOND No. _____

KNOW ALL MEN BY THESE PRESENTS: That_____
_____, as Principal, whose principal business address is:
_____
and phone number and fax numbers are: _____
and _____, as Surety, whose principal address is:
_____
_____
and phone number and fax numbers are: _____ are held and firmly bound to COLUMBIA COUNTY, FLORIDA (the "COUNTY") as Obligee in the sum of_____
_____ ($_____)
for the payment whereof we bind ourselves, our heirs, executors, personal representatives, successors and assigns, jointly and severally.

WHEREAS, Principal has entered into a contract dated as of the ____ day of _____, 20___, with Obligee for _____
in accordance with drawings and specifications, which contract is incorporated by reference and made a part hereof, and this referred to as the Contract.

THE CONDITION OF THIS BOND is that if Principal promptly makes payment to all claimants as defined in Section 255.05(1), Florida Statutes, supplying Principal with labor, materials or supplies, used directly or indirectly by Principal in the prosecution of the work provided for in the Contract, then is bond is void; otherwise it remains in full force.

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

The provisions of this bond are subject to the time limitations of Section 255.05(2). In no event will the Surety be liable in the aggregate to claimants for more than the penal sum of this Payment Bond, regardless of the number of suits that may be filed by claimants.

IN WITNESS WHEREOF, the above parties have executed this instrument this _____ day of _____, 20___, the name of each party being affixed and these presents duly signed by its under-signed representative, pursuant to authority of its governing body.
Signed, sealed and delivered in the presence of:

PRINCIPAL: _____
(Company Name of Contractor)

By:_____ (Officer's Signature)
_____ (Officer's Name Printed)

Witnesses as to Principal Name:_____ (Signature)
Its:_____ (Title)

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this ___day of _____, 20_____,

by_____ (officer's name), as

_____ (title) of _____, a

_____corporation, on behalf of the corporation. He/she is personally known to me OR has

produced_____ as identification and did (did not) take an oath.

My Commission Expires: _____
Signature of Notary: _____
(Legibly Printed) _____
(AFFIX OFFICIAL SEAL) Notary Public, State of _____
Commission No.:_____

ATTEST: SURETY:

_____
(Printed Company Name)
_____
_____
(Business Address)

_____ _____
(Surety Authorized Signature) (Printed Name)

Witness as to Surety: _____ (Signature)

_____(Printed Name)

OR

_____ _____

As Attorney in Fact (Signature) (Printed Name)

(Attach Power of Attorney)

Witnessed by: _____ _____

(Signature) (Printed Name)

_____

_____

(Business Address)

_____

(Telephone Number)

STATE OF _____
COUNTY OF _____

The foregoing instrument was acknowledged before me this ____day of _____, 20 __, by_____ (officer's name), as_____ (title) of_____ Surety, on behalf of Surety. He/She is personally known to me OR has produced _____ as identification and who did (did not) take an oath.

My Commission Expires: _____

Signature of Notary: _____

(Legibly Printed) _____

(AFFIX OFFICIAL SEAL)

Notary Public, State of _____

Commission No:_____

EXHIBIT F
INSURANCE REQUIREMENTS
CERTIFICATES OF INSURANCE

(1) The Contractor shall obtain and maintain such insurance as will protect it from: (1) claims under worker's compensation laws, disability benefit laws, or other similar employee benefit laws; (2) claims for damages because of bodily injury, occupational sickness or disease or death of his employees including claims insured by usual personal injury liability coverage; (3) claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees including claims insured by usual personal injury liability coverage; and (4) from claims for injury to or destruction of tangible property including loss of use resulting there from -- any or all of which claims may arise out of, or result from, the services, work and operations carried out pursuant to and under the requirements of the Contract Documents, whether such services, work and operations be by the Contractor, its employees, or by subcontractor(s), or anyone employed by or under the supervision of any of them, or for whose acts any of them may be legally liable.

(2) This insurance shall be obtained and written for not less than the limits of liability specified hereinafter, or as required by law, whichever is greater.

(3) The Contractor shall require, and shall be responsible for assuring throughout the time the Agreement is in effect, that any and all of its subcontractors obtain and maintain until the completion of that subcontractor's work, such of the insurance coverages described herein as are required by law to be provided on behalf of their employees and others.

(4) The Contractor shall obtain, have and maintain during the entire period of the Agreement insurance policies, which contain the following information and provisions:

(A) The name and type of policy and coverages provided;
(B) The amount or limit applicable to each coverage provided;
(C) The date of expiration of coverage;
(D) The designation of the COUNTY as an additional insured and a certificate holder. (This requirement may be excepted for Worke''s Compensation and professional liability Insurance.);
(E) The following clause must appear on the Certificate of Insurance:

Should any material change occur in any of the above described policies or should any of said policies be canceled before the expiration date thereof, the issuing company will mail at least thirty (30) days written notice to the COUNTY.

(5) If the initial, or any subsequently issued Certificate of Insurance expires prior to the completion of the Work or termination of the Agreement, the Contractor shall furnish to the COUNTY, in triplicate, renewal or replacement Certificate(s) of Insurance not later than thirty (30) calendar days prior to the date of their expiration. Failure of the Contractor to provide the COUNTY

with such renewal certificate(s) shall be considered justification for the COUNTY to terminate the Agreement.

(6) Contractor shall include the COUNTY, the COUNTY's agents, officers and employees in the Contractor's General Liability and Automobile Liability policies as additional insureds.

(7) If the COUNTY has any objection to the coverage afforded by other provisions of the insurance required to be purchased and maintained by Contractor in accordance with the requirements of the Contract Documents on the basis of its not complying with the Contract Documents, the COUNTY shall notify Contractor in writing thereof within thirty (30) days of the delivery of such certificates to the COUNTY. Contractor shall provide to the COUNTY such additional information with respect to its insurance as may be requested.

(8) The Contractor shall obtain and maintain the following insurance coverages as provided hereinbefore, and in the type, amounts and in conformance with the following minimum requirements:

WORKER'S COMPENSATION **[REVISE AS NEEDED TO MEET COUNTY'S REQUIREMENTS]**

State: Statutory
Applicable Federal:
(e.g. Longshoremen's) Statutory
Employer's Liability: $1,000,000.00

COMPREHENSIVE GENERAL LIABILITY

Bodily Injury: $1,000,000.00 Each Occurrence
Property Damage: $1,000,000.00 Each Occurrence

Comprehensive General Liability Insurance shall include:

Contractual Liability, Explosion, Collapse and Underground Coverages and Products and Completed Operations Coverages.

COMPREHENSIVE AUTOMOBILE LIABILITY

Bodily Injury: $1,000,000.00 Each Occurrence
Property Damage: $1,000,000.00 Each Occurrence

Comprehensive Automobile Liability shall include coverage for any owned auto, non-owned autos and hired autos.

EXHIBIT G
RELEASE AND AFFIDAVIT

COUNTY OF_____

STATE OF FLORIDA

Before me, the undersigned authority, personally appeared _____ _____, who after being duly sworn, deposes and says:

(1) In accordance with the Contract Documents and in consideration of $_____ paid, _____ ("Contractor") releases and waives for itself and its subcontractors, materialmen, successors and assigns, all claims demands, damages, costs and expenses, whether in contract or in tort, against Columbia County, Florida (the "COUNTY"), its Board of County Commissioners, employees and agents relating in any way to the performance of the Agreement between Contractor and the COUNTY, dated _____, ____, for the period from _____ to _____.

(2) Contractor certifies for itself and its subcontractors, materialmen, successors and assigns, that all charges for labor, materials, supplies, lands, licenses and other expenses for which the COUNTY might be sued or for which a lien or a demand against any payment bond might be filed, have been fully satisfied and paid.

(3) Contractor agrees to indemnify, defend and save harmless the COUNTY, its Board of County Commissioners, employees and agents from all demands or suits, actions, claims of liens or other charges filed or asserted against the COUNTY arising out of the performance by Contractor of the Work covered by this Release and Affidavit.

(4) This Release and Affidavit is given in connection with Contractor's [monthly/final] Application for Payment No._____.

CONTRACTOR:

_____

By: _____ (signature of the executive officer)

Its:_____ (title of the executive officer)

Date:_____

Witnesses

_____ _____

[Corporate Seal]

STATE OF _____

COUNTY OF _____

The foregoing instrument was acknowledged before me this _____ day of _____, _____, by _____, as _____ of _____, a _____ corporation, on behalf of the corporation. He/she is personally known to me or has produced _____ _____ as identification and did (did not) take an oath.

My Commission Expires: _____
(Signature of Notary)

Name:_____
(Legibly Printed)

(AFFIX OFFICIAL SEAL) Notary Public, State of_____

Commission No.:_____

EXHIBIT H
CHANGE ORDER FORM

CHANGE ORDER NO. _____ COLUMBIA COUNTY PROJECT NO. _____

TO: _____
_____
_____

DATE: _____

PROJECT NAME: _____

Columbia County Project No._____

Under our AGREEMENT dated_____.

****

You hereby are authorized and directed to make the following change(s) in accordance with terms and conditions of the Agreement:

_____
_____

FOR THE ADDITIVE or DEDUCTIVE Sum of:
_____($_____).

Original Agreement Amount $_____

Sum of Previous Changes $_____

This Change Order ADD/DEDUCT $_____

Present Agreement Amount $_____

The time for completion shall be (increased/decreased) by _____ calendar days due to this Change Order. Accordingly, the Contract Time is now _____ (_____) calendar days and the final completion date is _____. Your acceptance of this Change Order shall constitute a modification to our Agreement and will be performed subject to all the same terms and conditions as contained in our Agreement indicated above, as fully as if the same were repeated in this acceptance. The adjustment, if any, to the Agreement shall constitute a full and final settlement of any and all claims arising out of or related to the change set forth herein, including claims for impact and delay costs.

Accepted:_____ , 20____ .

COLUMBIA COUNTY, FLORIDA CONTRACTOR

By:_____ By:_____
Chair President

ENGINEER: By:_____

EXHIBIT I
NOTICE OF AWARD

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INSERT THE NOTICE OF AWARD BEHIND THIS COVER PAGE

EXHIBIT J

NOTICE TO PROCEED

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INSERT THE NOTICE TO PROCEEED BEHIND THIS COVER PAGE

EXHIBIT K

APPLICATION FOR PAYMENT

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INSERT THE APPLICATION FOR PAYMENT BEHIND THIS COVER PAGE

DIVISION 0

ENGINEER-PROVIDED CONTRACT DOCUMENTS

SECTION 00100
ADVERTISEMENT FOR BID
Bid No. 2022-1

PROJECT: Columbia County
North Florida Mega Industrial Park (NFMIP)
Wastewater Treatment Facility (WWTF)
153 Southeast Tyre Road
Lake City, Florida 32055

OWNER: Columbia County
Mr. Chad Williams, PE – County Engineer
135 NE Hernando Avenue
Lake City, Florida 32056-1529
Telephone: (386) 623-2452

ENGINEER: Jones Edmunds & Associates, Inc.
Thomas W. Friedrich, PE, BCEE – Engineer of Record (EOR)
730 NE Waldo Road
Gainesville, Florida 32641
Telephone: (352) 377-5821

1.0 WORK DESCRIPTION

The Project is at 153 Southeast Tyre Road, Lake City, Florida 32025. The location borders the southwest corner of the CoreCivic Lake City Youthful Offender Facility.

The Work is generally described as the construction of a 0.500-million-gallon-per-day (MGD) (annual average daily flow [AADF]) WWTF with reclaimed water land applied to a 162-acre restricted-access sprayfield. The sprayfield land is owned by Weyerhauser and an easement will be provided to the County for economic development and job creation within the NFMIP. Weyerhauser is providing the silviculture land for the NFMIP WWTP effluent spray-field to the County for an interim period (5 to 10 years).

The associated WWTF will serve NFMIP customers and will include construction of a 0.500-MGD AADF, Category 1, Class C, 4-Stage Bardenpho package WWTF, which includes headworks, equalization tanks, waste sludge aerobic digesters, and associated pumps, blowers, and appurtenances. The WWTF will meet the Santa Fe Best Management Action Plan (BMAP) requirements to produce reclaimed water with a Total-Nitrogen (TN) of less than or equal to 3.0 milligrams per liter of TN (mg/L-TN) on an Average Annual Basis.

The work general includes but is not limited to the following:

- A master influent pump station designed for Phase 1 peak-hour flow (PHF) of 1.5 MGD, and future PHF of 4.5 MGD.

- An influent headworks structure consisting of two mechanical drum screens of 1.5 MGD PHF capacity and a manual bypass screen.

- A 1,365,000-million-gallon (MG) WWTF with equalization and configured as a 4-Stage Bardenpho biological nutrient removal (BNR) unit treatment process. The WWTF consists of the following:

    - Two 211,000-gallon equalization tanks for a total volume of 422,000 gallons.
    - Two 74,000-gallon Stage 1 anoxic zones for a total volume of 148,000 gallons.
    - An internal recycle (nitrate recycle) pump station of 3.0 MGD (anoxic recycle ratio of 300 to 600% of influent Q).
    - Two 187,000-gallon aeration zones with fine-bubble diffusers and positive-displacement (PD) blowers for a total volume of 374,000 gallons.
    - Two 35,500-gallon second anoxic basins and two 5,000-gallon re-aeration basins for a total of 81,000 gallons.
    - Two secondary clarifiers of 89,000 gallons each and 881 square feet each of surface area for a total volume of 178,000 gallons.
    - Two aerobic digesters of 81,000 gallons each for a total volume of 162,000 gallons.

- Addition of supplemental carbon feed system to optimize the TN removal capabilities for the 4-Stage BNR WWTF.

- A cast-in-place chlorine contact tank (CCT) split into two 75,000-gallon chambers for a total volume of 150,000 gallons; disinfection is achieved by a chemical feed system using sodium hypochlorite.

- A clearwell at the end of the CCT contains two 700 gallons per minute (gpm) reclaimed water transfer pumps connecting to a lined 1.5-MG reclaimed water storage pond to allow 3 days of storage at the design AADF.

- A plant drain pump station and associated gravity collection system for retreatment and recycle of miscellaneous plant drains and sanitary flows.

- Leachate storage tanks and associated pumps, blowers, and aeration system to allow leachate from the County's Columbia County Winfield Class I Municipal Solid Waste (MSW) Landfill to be temporarily stored, equalized, and treated at the NFMIP WWTF.

- Construction of the approximately 9,500 linear feet of sprayfield force main and the Sprayfield Segment 1, which includes zones A, B, C, D, E, and G providing 106.5 acres of

spray irrigation area with associated buffer and spray header distribution piping and spray nozzles. Segment 2, shown for informational purposes only, includes Zones F, H, and I providing 56 acres of spray irrigation area with associated buffer and spray headed distribution piping and spray nozzles; Segment 2 will be installed in the future.

- Associated piping, roads, site civil, stormwater, buildings, electrical, instrumentation, and controls as shown on the Drawings.

The WWTF will be operated to provide advanced secondary treatment and basic level disinfection. Biosolids will be aerobically digested, decant thickened, and hauled by truck to a Residuals Management Facility (RMF) or be land-applied by a contract hauler to a Florida Department of Environmental Protection (FDEP) permitted site.

The Opinion of Probable Construction Cost is $17,473,000 to $20,232,000.

All work shall be in accordance with the Construction Drawings, Specifications, and Contract Documents.

2.0 RECEIPT OF BIDS

Bidding and Contract Documents may be examined upon registering at the County's web portal at the following link:

https://www.columbiacountyfla.com/PurchasingBids.asp

To ensure that Bidders receive all addenda and/or clarifications to the Bidding Documents in a timely manner, it is mandatory that all bidders obtain at least one set of Bidding Documents from the County to be eligible to bid on this project; electronic copies of the documents may be obtained through the County's web portal. Once a Bidder registers at the above link, all subsequent addenda will be issued via email unless the Bidder requests otherwise. Email BCCpurchasing@columbiacountyfla.com for further details and to obtain a set of Contract Documents.

Bids shall be completed on the enclosed Bid Form as set forth in the Instructions to Bidders and otherwise be in compliance with the Bidding Documents. Sealed bids will be received at the Columbia County Purchasing Department until 2:00 P.M. (local time) on May 10th, 2022, at which time and place all bids will be opened. Any Bids received after the specified time and date will not be considered.

A mandatory pre-bid conference will be held on April 19th, 2022, at 1:15 PM at: Duval Place, 971 West Duval Street, Suite 150, Lake City, FL 32055. Failure to attend a mandatory pre-bid conference will result in disqualification of prospective bidders. Only prospective bidders on the Engineer's plan holders list may submit a bid.

For further information or clarification, email BCCpurchasing@columbiacountyfla.com

END OF SECTION

SECTION 00200
INSTRUCTIONS TO BIDDERS

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

B. *Work and Project*—The work/project as described in Paragraph 1.0 of Section 00100, Advertisement for Bid.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents stated in the advertisement or invitation to bid may be obtained by registering at the County's web portal at the following link:

https://www.columbiacountyfla.com/PurchasingBids.asp

Once a Bidder registers at the above link, all subsequent addenda will be provided via email.

2.02 To assure that Bidders receive all addenda and or clarifications to the Bidding Documents in a timely manner, it is mandatory that all bidders obtain at least one set of Bidding Documents from the County (Owner) to be eligible to bid on this project. Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in providing electronic copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

2.04 Only bona fide general contractors, subcontractors, suppliers, individuals, or entity will be issued Bidding Documents. The requestor may be required to identify general contractor(s) that they are affiliated with or plan to submit a quote to. The Issuing Office reserves the right to investigate the intent of use of the Bidding Documents. If the Issuing Office determines that the requestor intends to use the Bidding Documents for any purpose other than bidding the Project, the request for Bidding Documents will be denied.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 A. To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit written evidence such as financial data, previous experience, present commitments, and such other data as may be called for in Section 00450 Construction Contractor's Qualification Statement for Engineered Construction.

B. Bidders shall provide State of Florida Contractor's License Number.

3.02 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 – EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 *Subsurface and Physical Conditions*

A. The Supplementary Conditions identify:

1. Those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site.

2. Those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by Owner to any Bidder as additional information as part of the Bidding Documents. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.03 of the General Conditions has been identified and established in Paragraph 5.03 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.02 *Underground Facilities*

A. Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others. Bidder is responsible for verifying the existence, location, depth, and type of utility.

4.03 *Hazardous Environmental Condition*

A. The Supplementary Conditions identify any reports and drawings known to Owner relating to a Hazardous Environmental Condition identified at the Site, that Engineer has used in preparing the Bidding Documents.

B. Copies of reports and drawings referenced in Paragraph 4.03.A will be made available by Owner to any Bidder as additional information as part of the Bidding Documents. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.06 of the General Conditions has been identified and established in Paragraph 5.06 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any "technical data" or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

4.04 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 Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.06 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests, and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.06 A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other 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 described by these Bidding Documents. 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 other work.

B. Paragraph 7.13.G of the General Conditions indicates that if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.07 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in Paragraph 5.03 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Paragraph 5.06 of the Supplementary Conditions as containing reliable "technical data";

E. consider the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder’s safety precautions and programs;

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work; and

J. correlate the information known to the Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and

all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

4.08 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 Bidding Documents and applying any specific means, methods, techniques, sequences, and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 – PRE-BID CONFERENCE

5.01 A mandatory pre-Bid conference will be held at *1:15 PM local time on* April 19th, 2022 *at Duval Place, 971 West Duval Street, Suite 150, Lake City, FL 32055.* Representatives of Owner and Engineer will be present to discuss the Project. Bidders are *required* to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Addenda will be issued via email unless the Bidder requests otherwise. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 – SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding 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.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to the Owner in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda emailed to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than 10 days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (on the form attached) issued by a surety meeting the requirements of Paragraphs 6.01.C and 6.01.D of the General Conditions.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Agreement or 121 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) finally completed and ready for final payment are set forth in Section 00410, Bid Form, and Section 00520, Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, or those substitute or "or-equal" materials and equipment approved by Engineer and identified on the Bid Form. The materials and equipment described in the Bidding Documents establish a standard of required type, function and quality to be met by any proposed substitute or "or-equal" item. No item of

material or equipment will be considered by Engineer as a substitute or "or-equal" unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids. Each such request shall conform to the requirements of Paragraphs 7.05 and 7.06 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, individual, or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit a substitute in which case apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 7.07 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.

ARTICLE 13 – PREPARATION OF BID

13.01 To assure that Bidders receive all addenda and/or clarifications to the Bidding Documents in a timely manner, it is mandatory that all bidders obtain at least one set of Bidding Documents from the Issuing Office to be eligible to bid on this project. The Bid form

included in these Bidding Documents shall be used by the Bidder. Additional copies may be obtained from the Issuing Office.

13.02 All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternative, adjustment unit price item, and unit price item listed therein. In the case of optional alternatives, the words "No Bid," "No Change," or "Not Applicable" may be entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be shown.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be shown.

13.06 A Bid by an individual shall show the Bidder's name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid Form. The official address of the joint venture shall be shown.

13.08 All names shall be printed in ink below the signatures**.**

13.09 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.10 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.11 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located. The Bidder shall also be a state-certified Contractor in good standing and hold current registration with the Florida Construction Industry Licensing Board of the State Department of Professional Regulation. The type of license must be in a class that is related to the general nature of the construction to be performed on this project. The Bidder's State Contractor's license number for the state of the project shall be shown on the Bid form.

ARTICLE 14 – BASIS OF BID; COMPARISON OF BIDS

14.01 *Lump Sum*

A. Bidders shall submit a Bid on a lump sum basis as set forth in the Bid Form.

14.02 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the Bid schedule.

B. The total of all estimated prices will be the sum of the products of the estimated quantity of each item and the corresponding unit price. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.03 *Allowances*

A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

ARTICLE 15 – SUBMITTAL OF BID

15.01 Each prospective Bidder is furnished with one copy of the Bidding Documents.

15.02 *The following documents shall be submitted with and made a part of the Bid:*

A. Required Bid security in the form of a certified check or Bid Bond (Section 00430).

B. Tabulation of Subcontractors and Suppliers (Section 00431).

C. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids.

D. Contractor’s License No.: _____.

E. Florida Trench Safety Act Certification (Section 00440).

F. Construction Contractor’s Qualification Statement for Engineered Construction (Section 00450).

G. Sworn Statement under Section 287.133(3)(A), Florida Statutes, on Public Entity Crimes (Section 00451).

H. Bidder's Statement of Disputes, Litigation, Arbitration, and Surety Completion, Last Three (3) Years (Section 00452).

I. Noncollusion Affidavit (Section 00453).

J. Drug-Free Workplace Certificate (Section 00454).

K. List of Project References.

L. Conflict of Interest Statement.

M. E-Verify.

15.03 A Bid shall be submitted in duplicate no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to Columbia County Purchasing Department, 135 NE Hernando Avenue, Suite 203, Lake City, Florida 32055.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids.

16.02 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement or Invitation to Bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

19.03 In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers, and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work in accordance with the Contract Documents.

19.06 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Owner.

ARTICLE 20 – CONTRACT SECURITY AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and

insurance. When the Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by such bonds.

20.02 Provisions for indemnification by the Contractor are set forth in the Agreement, in Paragraph 7.18 of the General Conditions, as amended by the Supplementary Conditions, and are incorporated here by reference.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the required number of unsigned counterparts of the Agreement along with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 10 days thereafter, Owner shall deliver one fully signed counterpart to Successful Bidder with a complete set of the Drawings with appropriate identification.

END OF SECTION

SECTION 00410
BID FORM

PROJECT ID: Columbia County
North Florida Mega Industrial Park (NFMIP)
Wastewater Treatment Facility (WWTF)
153 Southeast Tyre Road
Lake City, Florida 32055

ARTICLE 1 – BID RECIPIENT

1.01 THIS BID IS SUBMITTED TO:

Columbia County Purchasing Department
135 NE Hernando Avenue, Suite 203
Lake City, Florida 32056-1529
Phone: (386) 719-2028
Email: BCCpurchasing@columbiacountyfla.com

County Bid No.: 2022-1
Jones Edmunds Project No.: 03780-001-01

The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 120 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of which is hereby acknowledged:

Addendum No.	Addendum Date
_____	_____
_____	_____
_____	_____

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, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in SC-5.03 as containing reliable "technical data".

E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and (3) Bidder's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder 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 Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

J. Bidder certifies Bidder's authority and qualification to do business in the state where the Project is located, that the Bidder is a state-certified Contractor in good standing and holds current registration with the Florida Construction Industry Licensing Board of the Florida Department of Professional Regulation, that the type of license is in a class that authorizes the Bidder to perform the general nature of the construction to be performed on this project, and that the Bidder's State Contractor's license number for the state of the project is shown on the Bid form.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
BASE BID					
1	Mob, Demob, and General Conditions	LS	1	$	$
2	Environmental Protection	LS	1	$	$
3	Wastewater Treatment Plant (WWTP)	LS	1	$	$
4	Miscellaneous Concrete	CY	5	$	$
5	Testing Allowance	AL	1	$ 20,000	$ 20,000
6	Record Drawings	AL	1	$ 30,000	$ 30,000
	Total of All Base Bid Item Prices			$	
BID ALTERNATES					
A.1	Plant Access Roadway	LS	1	$	$
A.2	Pipes Along Plant Access Roadway	LS	1	$	$
A.3	Future Pipes Along Plant Access Roadway	LS	1	$	$
A.4	Electrical Along Plant Access Roadway	LS	1	$	$
A.5a	Piping to Sprayfield (HDPE)	LS	1	$	$
A.5b	Piping to Sprayfield (PVC)	LS	1	$	$
A.6	Sprayfield	LS	1	$	$

Bidder certifies that Unit Prices have been computed in accordance with Paragraph 13.02 of the General Conditions.

Bidder shall submit its Bid on the basis of the Base Bid and shall provide a separate Bid price for each additive alternative, if any, described in the Bidding Documents and as provided for on the Bid Form.

For determination of the apparent low Bidder, Bids will be compared on the basis of the aggregate amount of the Base Bid, plus any combination of the alternates as determined by the Owner.

Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the form of Agreement contained within the Bidding Documents.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a part of this Bid:

A. Required Bid security in the form of a certified check or Bid Bond (Section 00430).

B. Tabulation of Subcontractors and Suppliers (Section 00431).

C. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids.

D. Contractor's License No.: _____.

E. Florida Trench Safety Act Certification (Section 00440).

F. Construction Contractor's Qualification Statement for Engineered Construction (Section 00450).

G. Sworn Statement under Section 287.133(3)(A), Florida Statutes, on Public Entity Crimes (Section 00451).

H. Bidder's Statement of Disputes, Litigation, Arbitration, and Surety Completion, Last Three (3) Years (Section 00452).

I. Noncollusion Affidavit (Section 00453).

J. Drug-Free Workplace Certificate (Section 00454).

K. List of Project References.

L. Conflict of Interest Statement.

M. E-Verify.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid is submitted by:

If Bidder is:

An Individual

Name (typed or printed): _____

By: _____
(Individual's signature)

Doing business as: _____

A Partnership

Partnership Name: _____

By: _____
(Signature of general partner -- attach evidence of authority to sign)

Name (typed or printed): _____

A Corporation

Corporation Name: _____
(SEAL)

State of Incorporation: _____
Type (General Business, Professional, Service, Limited Liability):_____

By: _____
(Signature -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____
(CORPORATE SEAL)

Attest _____

Date of Qualification to do business in _*[State where Project is located]*_ is ____/____/____.

A Joint Venture

Name of Joint Venture: _____

First Joint Venturer Name: _____ (SEAL)

By: _____
(Signature of first joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

Second Joint Venturer Name: _____(SEAL)

By: _____
(Signature of second joint venture partner -- attach evidence of authority to sign)

Name (typed or printed): _____

Title: _____

(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.)

Bidder's Business Address _____

_____

Phone No. _____ Fax No. _____

E-mail _____

SUBMITTED on _____, 20____

State Contractor License No. _____

END OF SECTION

SECTION 00430
BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER *(Name and Address)*:

SURETY *(Name and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name and Include Location)*:

BOND

Bond Number:

Date *(Not earlier than Bid due date)*:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Above addresses are to be used for giving any required notice. Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00431
TABULATION OF SUBCONTRACTORS AND SUPPLIERS

The Undersigned states that the following is a full and complete list of the proposed subcontractors and suppliers on this Project and the class of work to be performed by each and that such list will not be added to nor altered without written consent to the Owner through the Engineer.

	SUBCONTRACTOR OR SUPPLIER AND ADDRESS	**CLASS OF WORK OR MATERIAL**
(1)		
(2)		
(3)		
(4)		
(5)		
(6)		
(7)		

BIDDER:_____

By:_____

Name:_____

Title:_____

Date:_____

SECTION 00440
FLORIDA TRENCH SAFETY ACT CERTIFICATION

The Bidder acknowledges that included in the various items of the proposal and in the Total Bid Price are costs for complying with the most current version of the Florida Trench Safety Act (90-96, Laws of Florida). The Bidder further identifies the costs to be summarized below:

	Cost
1. Trench Safety Act Compliance	$ _____
2. Special Shoring	$ _____

Identify method of compliance for Item #1: _____

_____

Identify or attach a copy of Special Shoring Requirements for Item #2: _____

_____

The undersigned certifies that he/she is the Contractor who will perform the trench excavation for this project and hereby gives written assurance that Contractor will comply with the applicable trench safety standards specifically set forth in Florida's Trench Safety Act (90-96, Laws of Florida).

BIDDER: _____

By: _____

Name: _____

Title: _____

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

_____
Notary Public

My Commission Expires: _____

SECTION 00450

THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA

CONSTRUCTION CONTRACTOR'S QUALIFICATION STATEMENT FOR ENGINEERED CONSTRUCTION

This qualification statement was developed by AGC of America in cooperation with the Engineers Joint Contract Documents Committee (EJCDC) which recommend its use as a suggested generic prequalification statement or a contract-specific qualification statement. In the latter case, the owner or engineer may wish to make appropriate supplemental inquires.

The Engineers Joint Contract Documents Committee consists of representatives of the following organizations:

National Society of Professional Engineers
American Consulting Engineers Council
American Society of Civil Engineers
Construction Specifications Institute

Submitted by:

Name of Organization _____

Name of Individual _____

Title _____

Address _____

_____

_____

Telephone _____

AGC DOCUMENT NO. 220 CONSTRUCTION CONTRACTOR'S QUALIFICATION STATEMENT FOR ENGINEERED CONSTRUCTION, © 1990, The Associated General Contractors of America.

Submitted to:

Name _____

Address _____

_____

_____

Telephone _____

Project Name and Description (if applicable)

_____

_____

_____

_____

Contractor's General Business Information

Check If:

☐ Corporation ☐ Partnership ☐ Joint Venture ☐ Sole Proprietorship

If Corporation:

a. Date and State of Incorporation

_____

_____

b. List of Executive Officers

Name	Title

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If Partnership:

a. Date and State of Organization

_____

_____

b. Names of Current General Partners

_____

_____

c. Type of Partnership

☐ General ☐ Publicly Traded

☐ Limited ☐ Other (describe): _____

If Joint Venture:

a. Date and State of Organization

_____

_____

b. Name, Address and Form of Organization of Joint Venture Partners: (Indicate managing partner by an asterisk *)

_____

_____

_____

_____

_____

If Sole Proprietorship:

a. Date and State of Organization

_____

_____

b. Name and Address of Owner or Owners

_____

_____

_____

_____

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1. On Schedule A, attached, list major engineered construction projects completed by this organization in the past five (5) years. (If joint venture list each participant's projects separately).

2. On Schedule B, attached, list current projects under construction by this organization. (If joint venture, list each participant's projects separately).

3. Name of surety company and name, address, and phone number of agent.

_____

_____

_____

4. Is your organization a member of a controlled group of corporations as defined in I.R.C. Sec. 1563?
☐ Yes ☐ No

If yes, show names and addresses of affiliated companies.

_____

_____

5. Furnish on Schedule C, attached, details of the construction experience of the principal individuals of your organization directly involved in construction operations.

6. Has your organization ever failed to complete any construction contract awarded to it? ☐ Yes ☐ No

If yes, describe circumstances on attachment.

7. Has any Corporate officer, partner, joint venture participant or proprietor ever failed to complete a construction contract awarded to him or her in their own name or when acting as a principal of another organization?
☐ Yes ☐ No

If yes, describe circumstances on attachment.

8. In the last five years, has your organization ever failed to substantially complete a project in a timely manner?
☐ Yes ☐ No

If yes, describe circumstances on attachment.

9. Indicate general types of work performed with your own work force.

_____

_____

10. If required, can your organization provide a bid bond for this project? ☐ Yes ☐ No

11. What is your approximate total bonding capacity?

☐ $500,000 to $2,000,000

☐ $2,000,000 to $5,000,000

☐ $5,000,000 to $10,000,000

☐ $10,000,000 or more

3C DOCUMENT NO. 220 • CONSTRUCTION CONTRACTOR'S QUALIFICATION STATEMENT FOR ENGINEERED CONSTRUCTION, 1990, The Associated General Contractors of America.

12. Describe the permanent safety program you maintain within your organization. Use attachment if necessary.

_____

_____

_____

_____

13. Furnish the following information with respect to an accredited banking institution familiar with your organization.

Name of Bank _____

Address _____

_____

_____

Account Manager _____

Telephone _____

I hereby certify that the information submitted herewith, including any attachment is true to the best of my knowledge and belief.

_____

By: _____

Title: _____

Dated: _____

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SCHEDULE A

Name, Location and Description of Project	Owner	Design Engineer	Date Completed	Contract Price	Reference/Contact Include Address and Phone

SCHEDULE B

Name, Location and Description of Project	Owner	Design Engineer	Contract Price	Amount Completed	Date of Scheduled Completion	Reference/Contact Include Address and Phone

SCHEDULE C - PERSONNEL

Name	Position	Date started with this organization	Date started in construction	Prior positions and experience in construction

SECTION 00451
SWORN STATEMENT UNDER SECTION 287.133(3)(a),
FLORIDA STATUTES, ON PUBLIC ENTITY CRIMES

(To be signed in the presence of a notary public or other officer authorized to administer oaths.)

STATE OF _____

COUNTY OF _____

Before me, the undersigned authority, personally appeared _____, who, being by me first duly sworn, made the following statement:

1. The business address of _____
(firm name of Bidder/Contractor)

is _____.

2. My relationship to _____
(firm name of Bidder/Contractor)

is _____ .
(relationship such as sole proprietor, partner, president, vice president)

3. I understand that a "public entity crime" as defined in Section 287.133 of the Florida Statutes includes 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 in Florida or with an agency or political subdivision of any other state or with the United States, including, but not limited to, any bid or contract for goods or services to be provided to any public entity or such an agency or political subdivision and involving antitrust, fraud, theft, bribery, collusion, racketeering, conspiracy, or material misrepresentation.

4. I understand that "convicted" or "conviction" is defined by the statute to mean a finding of guilt or a conviction of a public entity crime, with or without 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.

5. I understand that "affiliate" is defined by the statute to mean (1) a predecessor or successor of a person or a corporation 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; or (3) those officers, directors, executives, partners, shareholders, employees, members, and agents who are active in the management of an affiliate; or (4) a person or corporation who knowingly entered into a joint venture with a person who has been convicted of a public entity crime in Florida during the preceding 36 months.

6. Neither the Bidder/Contractor nor any officer, director, executive, partner, shareholder, employee, member or agent who is active in the management of the Bidder/Contractor, nor any affiliate of the Bidder/Contractor, has been convicted of public entity crime subsequent to July 1, 1989.

(Draw a line through Paragraph 6 if Paragraph 7 below applies.)

7. There has been a conviction of a public entity crime by the Bidder/Contractor, or an officer, director, executive, partner, shareholder, employee, member or agent of the Bidder/Contractor who is active in the management of the Bidder/Contractor or an affiliate of the Bidder/Contractor. A determination has been made pursuant to Section 287.133(3) by order of the Division of Administrative Hearings that it is not in the public interest for the name of the convicted person or affiliate to appear on the convicted vendor list. The name of the convicted person or affiliate is_____.

A copy of the order of the Division of Administrative Hearings is attached to this statement.

(Draw a line through Paragraph 7 if Paragraph 6 above applies.)

_____
(Signature)

Sworn to and subscribed to before me in the State and County first mentioned above on the _____day of _____, 20____ .

_____
Notary Public

(affix seal)

_____
My commission expires

SECTION 00452
BIDDER'S STATEMENT OF DISPUTES, LITIGATION,
ARBITRATION, AND SURETY COMPLETION
LAST THREE (3) YEARS

PROJECT	NAME AND ADDRESS OF OWNER OR ENGINEER	NAME AND PHONE OF OWNER OR ENGINEER REPRESENTATIVE	DATE OF CONTRACT	AMOUNT	STATUS

(Signed)_____

SECTION 00453

NONCOLLUSION AFFIDAVIT

TO: The _____, herein called the "Owner."

Pursuant to bidding requirements for the work titled "_____

_____,"

the enclosed contract documents shall be provided to the Owner.

State of _____

County of _____

_____, being first duly
(Officer's Name)

sworn, deposes, and says that:

A. He\She is _____ (officer's title) of _____(company name), the Bidder that has submitted the attached bid;

B. He\She is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such bid;

C. Such bid is genuine and is not a collusive or sham bid;

D. Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees, or parties in interest, including this affiant, has 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 has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other 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 element 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 the _____ or any person interested in the proposed contract; and

E. 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 of its agents, representatives, owners, employees, or parties in interest, including this affiant.

(Signed) _____

_____

Subscribed and sworn to before me
this _____ day of _____, 20_____

_____
Notary Public

My commission expires _____

SECTION 00454
DRUG-FREE WORKPLACE CERTIFICATE

I, the undersigned, in accordance with Florida Statute 287.087, hereby certify that _____
_____(Print or Type Name of Firm)

- ☐ Publishes a written statement notifying that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the workplace named above, and specifying actions that will be taken against violations of such prohibition.

- ☐ Informs employees about the dangers of drug abuse in the workplace; the firm's policy of maintaining a drug-free working environment and available drug counseling, rehabilitation, and employee assistance programs; and the penalties that may be imposed upon employees for drug-use violations.

- ☐ Gives each employee engaged in providing commodities or contractual services that are under bid or proposal a copy of the statement specified above.

- ☐ Notifies the employees that as a condition of working on the commodities or contractual services under bid or proposal, the employee will abide by the terms of the statement and will notify the employer of any conviction of or plea of guilty or nolo contendere to any violation of Chapter 1893 or any controlled substance law of the State of Florida or the United States for a violation occurring in the workplace, no later than 5 days after such conviction, and requires employees to sign copies of such written statement to acknowledge their receipt.

- ☐ Imposes a sanction on or requires the satisfactory participation in a drug-abuse assistance or rehabilitation program, if such is available in the employee's community, by any employee who is so convicted.

- ☐ Makes a good faith effort to continue to maintain a drug-free workplace through the implementation of the drug-free workplace program.

"As a person authorized to sign this statement, I certify that the business, firm, or corporation named above complies fully with the requirements set forth herein."

_____
Authorized Signature

_____
Date Signed

State of: _____

County of: _____

Sworn to and subscribed before me this __ day of _____, 20___

Personally known __ or Produced Identification _____
(Specify Type of Identification)

_____
Signature of Notary

My Commission Expires_____

SECTION 00614

Public Work

F.S. Chapter 255.05 (1)(a)

Cover Page

THIS BOND IS GIVEN TO COMPLY WITH SECTION 255.05 OR SECTION 713.23 FLORIDA STATUTES, AND ANY ACTION INSTITUTED BY A CLAIMANT UNDER THIS BOND FOR PAYMENT MUST BE IN ACCORDANCE WITH THE NOTICE AND TIME LIMITATION PROVISIONS IN SECTION 255.05(2) OR SECTION 713.23 FLORIDA STATUTES.

BOND NO: _____

CONTRACTOR NAME: _____

CONTRACTOR ADDRESS: _____

_____

CONTRACTOR PHONE NO: _____

SURETY COMPANY: _____

_____

_____

OWNER NAME: Columbia County_____

OWNER ADDRESS: 135 NE Hernando Avenue _____

Lake City, Florida 32055 _____

OWNER PHONE NO.: 386-758-5405 _____

OBLIGEE NAME: (If contracting entity is different from the owner, the contracting public entity) _____

OBLIGEE ADDRESS: _____

_____

OBLIGEE PHONE NO.: _____

BOND AMOUNT: _____

CONTRACT NO.: (If applicable) _____

DESCRIPTION OF WORK: _____

_____

PROJECT LOCATION: 153 Southeast Tyre Road _____

Lake City, Florida 32025 _____

LEGAL DESCRIPTION: (If applicable) _____

_____

FRONT PAGE

All other bond page(s) are deemed subsequent to this page regardless of any page number(s) that may be printed therein.

END OF SECTION

SECTION 00625
CERTIFICATE OF SUBSTANTIAL COMPLETION

Project:	
Owner:	Owner's Contract No.:
Contract:	Engineer's Project No.:

This Tentative **Certificate of Substantial Completion applies to:**

☐ All Work under the Contract Documents: ☐ The following specified portions of the Work:

_____

_____

_____

_____

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below.

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 any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Documents except as amended as follows:

☐ Amended Responsibilities ☐ Not Amended

Owner's Amended Responsibilities:

_____

_____

_____

_____

Contractor's Amended Responsibilities:

_____

_____

_____

_____

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

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	Date
Accepted by Contractor	Date
Accepted by Owner	Date

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

EJCDC®
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

ACEC
AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASCE
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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

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

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

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

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
   1. A mutually acceptable fixed fee; or
   2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
      a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
      b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
      c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
      d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
      e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
      f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

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

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SECTION 00800
SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC C-700 (2018 Edition) and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplemental Conditions will have the meanings indicated in the General Conditions. Additional terms used in these Supplemental Conditions have the meanings indicated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions with the prefix changed to "SC".

ARTICLE 1 DEFINITIONS AND TERMINOLOGY

Add the following new paragraph immediately after Paragraph 1.01.45:

SC-1.01.46 SURETY - The person, firm, or corporation which is bound by the contract bonds with and for Contractor (Principal); and which is held and firmly bound unto Owner for the conditions of obligations set forth in said bonds.

ARTICLE 2 PRELIMINARY MATTERS

Delete Paragraph 2.01.B in its entirety and insert the following in its place:

SC-2.01.B Before any Work at the Site is started, Contractor shall deliver to the Owner, certificates of insurance that Contractor is required to purchase and maintain in accordance with Article 6.

SC-2.01 Add the following new paragraph immediately after Paragraph GC-2.01.C:

SC-2.01.D Additional Insureds include the respective officers, partners, directors, employees, agents, consultants, and subconsultants of the following firms and municipal government(s):

a) Columbia County (Owner)
b) Jones Edmunds & Associates, Inc. (Engineer)

SC-2.02.A Amend the first sentence of Paragraph 2.02.A of the General Conditions by changing "four" to "five".

SC-2.03.A Amend the first sentence of Paragraph 2.03.A of the General Conditions by changing "Within 10 days after the Effective date of the Contract" to "At the Preconstruction Conference".

SC-2.04.A Amend the first sentence of Paragraph 2.04.A of the General Conditions by changing "Before any Work at the Site is started" to "Within twenty (20) days after the Owner signs the Agreement."

ARTICLE 3 CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

Delete Paragraph 3.03.B in its entirety and insert the following in its place:

SC-3.03.B Notwithstanding the provisions of Paragraph 3.03A, where conflict, error, ambiguity, or discrepancy exists within or between the Contract Documents, the more stringent requirements apply; otherwise the order of precedence (from highest to lowest) of the Contract Documents shall be as follows:

a) Change Orders and Field Orders, with the most recently issued instrument having precedence;
b) Addendums with the most recently issued instrument having precedence;
c) Bidding Requirements;
d) These Supplementary Conditions;
e) The General Conditions;
f) Technical Specifications;
g) Drawings;
h) The provisions of any standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents);
i) The provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

Figure dimensions in Drawings shall take precedence over scale dimensions. Detailed Drawings shall take precedence over general Drawings.

ARTICLE 4 COMMENCEMENT AND PROGRESS OF THE WORK

SC 4.01.A Amend the third sentence of Paragraph 4.01.A of the General Conditions by changing "60th" to "120th".

Add the following new paragraph immediately after Paragraph 4.01.A:

SC-4.01.B Owner may issue Notice to Proceed at the Preconstruction Conference. Contractor shall begin the Work within (24) hours of the date given in the Notice to Proceed.

If Contractor does not start the Work within ten (10) days after this date, Owner may, at his discretion, terminate Contractor in accordance with Paragraph 16.02.

ARTICLE 5 SITE, SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

Add the following to the end of Paragraph 5.01.C:

SC-5.01.C Contractor shall obtain said land rights at his own expense and without liability to the Owner. Contractor shall not enter upon private property without first obtaining written permission from the rightful property owner.

Add the following new paragraphs immediately after Paragraph 5.03.A.3:

SC-5.03.A.4 In the preparation of Drawings and Specifications, Engineer or Engineer's Consultants relied upon the following reports of explorations and tests of subsurface conditions at the Site:

- Geotechnical Report – GSE.
- Geotechnical Report – Ardaman.

SC-5.03.A.5 Copies of these reports and drawings itemized in SC-5.03.A.4 that are not included with the Bidding Documents may be examined at the Engineer's office during regular business hours. These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Contractor may rely as identified and established above are incorporated therein by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer and Engineer's Consultants in the preparation of Drawings and Specifications.

Add Paragraph following 5.04.E.4:

SC-5.04.E.5 However, Owner, Engineer, and Engineer's Consultants shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

Add Paragraph following 5.06.A.3:

SC-5.06.A.4 *Reports and Drawings:* In the preparation of Drawings and Specifications, Engineer or Engineer's consultants relied upon the following reports and drawings relating to Hazardous Environmental Conditions at the site:

- None.

SC-5.06.J Amend the first Paragraph of 5.06.J of the General Conditions by changing "(including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs)" to "(including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs)"

ARTICLE 6 BONDS AND INSURANCE

Delete Paragraph 6.01.C in its entirety and insert the following in its place:

SC-6.01.C All Bonds shall be in the form prescribed by the Contract Documents or other form approved by Owner. All else notwithstanding, the terms of all Payment Bonds shall be substantially in the form prescribed by Chapter 255, Florida Statutes. All Bonds shall be executed by Contractor and a Surety licensed to transact such business in the State of Florida and named on the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular Number 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. Contractor will cause the Bonds to be recorded with the Clerk of the Circuit Court in the county in which the Work is to be performed. Failure of the Contractor to deliver required Bonds in the form prescribed may constitute an event justifying termination for cause pursuant to Article 16. The expense for all Bonds shall be Contractor's responsibility.

Insert the following sentence at the end of Paragraph 6.01.D:

SC-6.01.D Bonds shall be issued by a company with a Best's rating of at least B+ authorized to do business in the state of Florida

Amend the last sentence in Paragraph 6.02.B as follows:

SC-6.02.B Insurance shall be issued by a company with a Best's rating of at least B+ authorized to do business in the State of Florida.

SC-6.02.E Delete Paragraph 6.02.E in its entirety and insert the following in its place:

Add the following new paragraphs immediately after Paragraph 6.02.N:

SC-6.02.O Umbrella Liability insurance is preferred, but an Excess Liability equivalent is acceptable. Whichever type of coverage is provided, it shall not be more restrictive than the underlying insurance policy coverages, including, but not limited to the coverage Trigger, defense, notice of occurrence/accident/ circumstances, notice of claim and extended reporting period.

SC-6.02.P No work shall be commenced under this contract until the required Certificate(s) have been provided. Work shall not continue after expiration (or cancellation) until new Certificate(s) have been provided. Non-continuance of work after expiration (or cancellation) of Certificate(s) will not constitute a delay beyond Contractor's control as defined in Paragraph 4.05.

SC-6.02.Q Contractor shall arrange for its insurers' policies to include, or be endorsed to include, a severability of interest/cross liability provision, so that Owner will be treated as if a separate policy were in existence, but without increasing the policy limits.

SC-6.02.R Insurance required of Contractor or any other insurance of Contractor shall be considered primary and insurance or self-insurance of Owner shall be considered excess, as may be applicable to claims that arise out of this Contract.

Add the following new paragraphs immediately after Paragraph 6.03.C:

SC-6.03.D The limits of liability for the insurance required by Paragraph 6.03.A of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers compensation and related coverages under Paragraphs 6.03.A of the General Conditions:

a.	State		Statutory
b.	Applicable Federal (e.g., Longshoreman's)		Statutory
c.	Employer's Liability	Each Employee	$1,000,000
		Each Accident	$1,000,000
		Disease Policy Limit	$1,000,000
		Disease Each Employee	$1,000,000

2. Contractor's General Liability under Paragraphs 6.03.A of the General Conditions, which shall also include completed operations and product

liability coverages and eliminate the exclusion with respect to property under the care, custody, and control of Contractor:

a. General Aggregate
(Except Products - Completed Operations) $1,000,000

b. Products – Completed Operations Aggregate $1,000,000

c. Each Occurrence
(Bodily Injury and Property Damage) $1,000,000

d. Property Damage liability insurance may be required to include Explosion, Collapse and Underground coverages where applicable.

e. Excess or Umbrella Liability
General Aggregate $2,000,000
Each Occurrence $1,000,000

3. Automobile Liability under Paragraph 6.03.A of the General Conditions:
Combined Single Limit $1,000,000

4. Additional Insureds include the respective officers, partners, directors, employees, agents, consultants, and subconsultants of the following firms and municipal government(s):

a) Columbia County (Owner)
b) Jones Edmunds & Associates, Inc. (Engineer)

SC-6.04.B.1. Add the following after SC-6.04.B as a separate paragraph:

Additional Insureds shall include the following:

a) Columbia County (Owner)
b) Jones Edmunds & Associates, Inc. (Engineer)

SC-6.04.C.1 Add the following after Paragraph 6.04.C:

Additional Insureds shall include the following:

a) Columbia County (Owner)
b) Jones Edmunds & Associates, Inc. (Engineer)

Add the following paragraph after Paragraph 6.06.C:

SC-6.07 If Owner has any objection to the coverage afforded by or other provisions of Bonds or insurance required to be purchased and maintained by Contractor in accordance with Article 6 on the basis of non-conformance with the Contract Documents, Owner shall so notify Contractor in writing within 10 days after receipt of the certificates (or other evidence requested). Contractor shall provide to Owner such additional information in respect of insurance provided as Owner may reasonably request.

ARTICLE 7 CONTRACTOR'S RESPONSIBILITIES

Add the following new paragraph immediately after Paragraph 7.01.B:

SC-7.01.C Owner reserves the right to reject any means, methods, techniques, sequences, or procedures proposed by Contractor which:

1. will not produce finished work in accordance with the terms of the Contract Documents.

Owner's failure to exercise his right to reject such means, methods, techniques, sequences, or procedures shall not relieve the Contractor of his obligation to accomplish the result intended in the Contract Documents nor shall the exercise of such right to reject create a cause of action for damages.

SC-7.03.C Amend the following “regular working hours” to “the hours between 7:00 AM and 7:00 PM”

Add the following new paragraph immediately after Paragraph 7.03.C:

SC-7.03.D Engineer shall record time and costs required by Engineer and Engineer's Consultants to provide services due to Contractor's working beyond regular working hours as defined in the General Requirements. Owner's reimbursement for the charges shall be a deduction from Contractor's Partial Payment(s).

Add the following new paragraphs immediately after Paragraph 7.06.A.3.d:

SC-7.06.A.3.e each action mentioned above required for review of proposed substitute items of material or equipment shall be followed in the order given. Failure to do so shall be cause for rejection of the proposed substitution.

Add the following to the end of Paragraph 7.07.A:

SC-7.07.A The Contractor shall not subcontract part(s) of the work, the aggregate cost of which is greater than 50 percent of the contract price, without prior written approval by Owner. Contractor shall cause appropriate provisions to be inserted in each subcontract making the Owner and Engineer a third party beneficiary of such subcontract and to give Contractor the same power as regards terminating any subcontract that Owner may exercise over Contractor under any provision of the Contract Documents. Each Subcontractor shall discharge all duties and responsibilities of Contractor to Owner covered by his subcontract.

SC-7.09.A Change "Owner" to "Contractor" in the last sentence of Paragraph 7.09.A.

Add the following to the end of Paragraph 7.11.A:

SC-7.11.A The Contractor shall also cause all Subcontractors to comply with all Laws and Regulations bearing on the conduct of the Work.

Insert the following at the beginning of Paragraph 7.11.B:

SC-7.11.B If Contractor observes that the Contract Documents are at variance with Laws or Regulations, Contractor shall promptly notify Engineer in writing. Contractor shall not proceed with the Work until so instructed by Owner. Any necessary adjustments to the Contract Price or the Contract Times shall be made as provided in the Contract Documents.

Add the following to the end of Paragraph 7.12.A:

SC-7.12.A Annotation of record documents shall be legible, precise, and complete as determined by Engineer. Record drawings shall also meet all additional requirements, if any, as specified in the Contract Documents including providing an electronic CAD version.

Add the following new paragraph immediately after Paragraph 7.13.C.3:

SC-7.13.C.4 The Contractor shall be responsible at all times for precautions to achieve the protection of all persons, including employees and property. Contractor shall make special effort to detect hazardous conditions and shall take prompt action where necessary to avoid accident, injury, or property damage. OSHA and all other applicable safety laws and ordinances shall be followed as well as American National Standards Institute Safety Standards. All accidents, injuries, claims, or potential claims shall be reported promptly to Owner.

Add the following new paragraph immediately after Paragraph 7.16.D.3:

SC-7.16.D.4 The Contractor shall reimburse Owner for the charges of Engineer and Engineer's Consultants for costs generated as a result of more than two submittals of any one Shop Drawing or Sample being required for evaluation due to rejection for noncompliance of the original submittal or for lack of information required by the Contract Documents. Owner's reimbursement for the charges shall be a deduction from Contractor's Partial Payment(s).

SC-7.16 E.1.b Remove Paragraph 7.16 E.1.b in its entirety.

SC-7.18.A Amend the first paragraph of 7.18.A of the General Conditions by changing "(including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs)" to "(including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs)"

Add the following new paragraph immediately after Paragraph 7.18.B:

SC-7.18.C Neither Contractor nor 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.

ARTICLE 9 OWNER'S RESPONSIBILITIES

SC-9.02 A. Amend Paragraph 9.02 A. of the General Conditions by striking out the following words: ", provided Contractor makes no reasonable objection to the replacement engineer."

ARTICLE 10 ENGINEER'S STATUS DURING CONSTRUCTION

Add the following new paragraphs immediately after Paragraph 10.03.B:

SC-10.03.C The Resident Project Representative is the Engineer's agent at the site, will act as directed by and under the supervision of the Engineer, and will confer with the Engineer regarding the Resident Project Representative's actions. The Resident Project Representative's dealings in matters pertaining to the on-site work shall in general be with the Engineer and the Contractor keeping the Owner advised as necessary. The Resident Project Representative's dealings with subcontractors shall only be through or with the full knowledge and approval of the Contractor. The Resident Project Representative shall generally communicate with the Owner with the knowledge of and under the direction of the Engineer.

SC-10.03.C.1 Duties and Responsibilities of the Resident Project Representative

SC-10.03.C.1.a Schedules: Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by the Contractor and consult with the Engineer concerning acceptability.

SC-10.03.C.1.b Conferences and Meetings: Attend meetings with the Contractor, such as preconstruction conferences, progress meetings, job conferences, and other project-related meetings, and prepare and circulate copies of minutes thereof.

SC-10.03.C.1.c Liaison:

i. Serve as Engineer's liaison with the Contractor, working principally through the Contractor's superintendent and assist in understanding the intent of the Contract Documents; and assist the Engineer in serving as the Owner's liaison with the Contractor with the Contractor's operations affect the Owner's onsite operations.
ii. Assist in obtaining from the Owner additional details or information, when required for proper execution of the Work.

SC-10.03.C.1.d Shop Drawings and Samples:

i. Record date of receipt of Shop Drawings and samples.
ii. Receive samples which are furnished at the site by the Contractor, and notify the Engineer of availability of samples for examination.
iii. Advise the Engineer and Contractor of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been reviewed by the Engineer.

SC-10.03.C.1.e Review of Work, Rejection of Defective Work, Inspections and Tests:

i. Conduct onsite observations of the Work in progress to assist the Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
ii. Report to the Engineer whenever the Resident Project Representative believes that any Work is unsatisfactory, faulty, or defective, or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test, or approval required to be made; and advise the Engineer of Work that the Resident Project Representative believes should be corrected or rejected or should be uncovered for observation, or required special testing, inspection, or approval.
iii. Verify that tests, equipment, and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that the Contractor maintains adequate records thereof; and

observe, record, and report to the Engineer appropriate details relative to the test procedures and startups.

iv. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project; record the results of these inspections and report to the Engineer.

SC-10.03.C.1.f Interpretation of Contract Documents: Report to the Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to the Contractor clarifications and interpretations as issued by the Engineer.

SC-10.03.C.1.g Modifications: Consider and evaluate the Contractor's suggestions for modifications in Drawings or Specifications and report with recommendations to the Engineer. Transmit to the Contractor decisions as issued by the Engineer.

SC-10.03.C.1.h Records:

i. Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project-related documents.

ii. Keep a diary or log book recording the Contractor's hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to the Engineer.

iii. Record names, address, and telephone numbers of all contractors, subcontractors, and major suppliers of materials and equipment.

SC-10.03.C.1.i Reports:

i. Furnish the Engineer with periodic reports as required of progress of the Work and of the Contractor's compliance with the progress schedule and schedules of Shop Drawing and sample submittals.

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

iii. Draft proposed Change Orders and Work Directive Changes, obtaining backup material from the Contractor and recommend to the Engineer Change Orders, Work Directive Changes, and Field Orders.

iv. Report immediately to the Engineer and Owner upon the occurrence of any accident.

SC-10.03.C.1.j Payment Requests: Review applications for payment with the Contractor for compliance with the established procedure for their submission and forward with recommendations to the Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the site but not incorporated in the Work.

SC-10.03.C.1.k Certificates, Maintenance, and Operation Manuals: During the course of the Work, verify that certificates, maintenance, and operation manuals and other data required to be assembled and furnished by the Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to the Engineer for review and forwarding to the Owner prior to final payment for the Work.

SC-10.03.C.2 Completion:

i. Before the Engineer issues a Certificate of Substantial Completion, submit to the Contractor a list of observed items requiring completion or correction.
ii. Conduct final inspection in the company of the Engineer, Owner, and Contractor, and prepare a final list of items to be completed or corrected.
iii. Observe that all items on the final list have been completed or corrected and make recommendations to the Engineer concerning acceptance.

Add the following new paragraphs after Paragraph 10.07.E:

SC-10.07.E.1 Limitations of Authority of the Resident Project Representative:

SC-10.07.E.1.a Shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by the Engineer.

SC-10.07.E.1.b Shall not exceed limitations of the Engineer's authority as set forth in the Contract Documents.

SC-10.07.E.1.c Shall not undertake any of the responsibilities of the Contractor, subcontractors, or Contractor's superintendent.

SC-10.07.E.1.d Shall not advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences, or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

SC-10.07.E.1.e Shall not advise on, issue directions regarding, or assume control over safety precautions and programs in connection with the Work.

SC-10.07.E.1.f Shall not accept Shop Drawing or sample submittals from anyone other than the Contractor.

SC-10.07.E.1.g Shall not authorize the Owner to occupy the Project in whole or in part.

SC-10.07.E.1.h Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by the Engineer.

ARTICLE 12 CLAIMS

SC-12.01.B Amend the first sentence of Paragraph 12.01.B by changing: "(but in no event later than 30 days)" to "(but in no event later than 15 days)" and "…Change Proposals within 30 days…" to "…Change Proposals within 15 days…"

ARTICLE 13 COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK

Add the following to the end of Paragraph 13.01.B.5.c.1:

SC-13.01.B.5.c.1 In no case shall rates exceed those published by the current edition of Data Quest Incorporated titled, Rental Rate Blue Book for Construction Equipment, and other procedures established by Florida Department of Transportation.

Add the following to the end of Paragraph 13.01.B.5.c.2:

SC-13.01.B.5.c.2 In no case shall the rates exceed the edition of RS Means in effect when the Contract was executed.

Amend Paragraph 13.01.B.5.f as follows:

SC-13.01.B.5.f Amend the first sentence of Paragraph 13.01.B.5.f by striking out the following words: "(except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.04),"

Add the following new paragraph immediately after Paragraph 13.01.B.5.i:

SC-13.01.B.5.j The cost of compliance with current local, state, and federal safety regulations.

Add to the following paragraphs after Paragraph 13.03.E.2:

SC-13.03.E.2.a The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1) if the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement; and

2) if there is no corresponding adjustment with respect to any other item of work; and

3) if Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

Add the following new paragraphs immediately after Paragraph 13.03.E.3:

SC-13.03.F If Owner objects to Contractor's quoted adjustment in Unit Price Work set forth in Paragraph 13.03.D, Owner may assign such work to its own forces or another contractor.

SC-13.03.G Owner reserves the right to delete any Unit Price Work with the change, if any, in the Contract Price or in the Contract Times determined in accordance with Article 11.

ARTICLE 14 TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

Add the following to the end of Paragraph 14.02.A:

SC-14.02.A Contractor shall reimburse Owner for the charges of Engineer and Engineer's Consultants for all costs due to work not being ready for tests and/or inspections when the Contractor has notified Engineer that work is ready for tests and/or inspections. Contractor shall reimburse Owner for all failed tests and subsequent retests. Partial payments payable to Contractor shall be distributed, first to reimburse the Owner for such charges, with the balance distributed to the Contractor in accordance with the Contract Documents.

Delete Paragraph 14.02.B of the General Conditions and add the following in its place:

SC-14.02.B Contractor shall also submit unit costs for specified tests to be reimbursed by the Testing Allowance. All field work, including labor, equipment, travel, etc., performed by the approved independent testing laboratory is the responsibility of the Contractor and shall be included in the Contract Price. These costs are not included in the allowance.

Copies of all testing agency invoices submitted to the Contractor for payment shall be forwarded with the Contractor's request for partial payment. Invoices shall be submitted routinely throughout the project and shall be pertinent to the partial payment period under consideration. Testing agency invoices in excess of sixty (60) days old shall not be considered for payment. Invoices shall clearly indicate type and amount of tests performed, unit and total cost, and shall indicate if the invoiced testing cost is a result of retests required due to the Contractor's failure to achieve specified requirements. The cost of retesting due to test failure will be borne by the Contractor. Payment to the Contractor for testing shall not be made without the required itemized invoicing.

Add the following new paragraph immediately after Paragraph 14.03.F:

SC-14.03.G The Contractor shall reimburse the Owner for the charges of the Engineer and Engineer's consultants for any additional field observations, engineering analysis, correspondence, meetings, or other work due to non-complying or defective construction, materials, or equipment performed or furnished by the Contractor, subcontractors, or suppliers. Owner’s reimbursement for the charges shall be a deduction from the Contractor's Partial Payment(s).

SC-14.07.A Amend the first sentence of 14.07.A by. changing “Engineer” to “Owner (or, prior to Engineer’s recommendation of final payment, Engineer)”.

SC-14.07.C Add the following to the end of Paragraph 14.07.C “Including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs)”.

ARTICLE 15 PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

Delete Paragraph 15.01.B.3 in its entirety and insert the following in its place:

SC-15.01.B.3 Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor certifying that Contractor has disbursed to all subcontractors and suppliers having an interest in the contract their pro rata shares of the payment out of previous progress payments received by Contractor for all

work completed and materials furnished in the previous period, less a retainage withheld by Contractor pursuant to an agreement with a subcontractor. Contractor shall provide a waiver of lien for all stored materials with the second application for payment after submitting application for payment. If the waiver of lien is not provided, current application for payment will be reduced by the value of the stored materials until said time waiver of lien is received or stored materials become incorporated in the Work. Within 30 days of receipt for the final progress payment or any other payments received thereafter except the final payment, Contractor shall pay all subcontractors and suppliers having an interest in the contract their pro rata shares of the payment for all work completed and materials furnished.

SC-15.01.C.1 Amend the last sentence of the paragraph by adding the following words: "or direct Engineer to present the Application to Owner with Engineer's recommendation of partial payment."

SC-15.01.C.2 After the word "schedules", add the words "and the Contract Documents."

Add the following new paragraph immediately after Paragraph 15.01.C.2.c:

SC-15.01.C.2.d Contractor's other obligations under the Contract Documents have been fulfilled.

Add the following new paragraph immediately after Paragraph 15.01.D.1:

SC-15.01.D.2 The Owner shall make payments of all approved invoices to the Contractor in accordance with the Local Government Prompt Payment Act, per Florida Statutes, Section 218.70.

SC-15.04.A.3 Amend the paragraph by changing "make an inspection of" to "make an observation of".

SC-15.05.A Change (i) title "Final Inspection" to "Site Observation", (ii) in first sentence, second line "final inspection" to "site observation", and (iii) in first sentence, third line "inspection" to "observation".

Amend the last sentence of Paragraph 15.06.E:

SC-15.06.E Change "Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer." to "The Owner shall make payments of all approved invoices to the Contractor in accordance with the Local Government Prompt Payment Act, per Florida Statutes, Section 218.70."

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

SC-16.02.A.1 Add the following before the beginning of the first sentence “Contractor’s failure to start the work in accordance with the Notice to Proceed or Contract documents”.

SC-16.03.A.1 Delete Paragraph 16.03.A.1 in its entirety and insert the following in its place:

all acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work, to be measured by applying the percentage of completion of each item of such Work to the scheduled value of each item as stated in the Schedule of Values, less previous payments made for such item;

SC-16.03.A.2 Delete Paragraph 16.03.A.2 in its entirety.

END OF SECTION

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

REQUEST FOR INFORMATION (RFI) No. ____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

TO: _____ DATE: _____

RE: CONTRACT DOCUMENT REFERENCE(S): _____

FROM: _____

DESCRIPTION OF RFI:

☐ INFORMATION ☐ CLARIFICATION ☐ INTERPRETATION

is Requested for the Items Described Below or in the Attached:

RESPONSE REQUESTED BY: _____ _____
DATE *SIGNATURE*

TO: _____ DATE: _____

FROM: _____

RESPONSE TO RFI NO.: _____

Our Response to your Request for ☐ INFORMATION ☐ CLARIFICATION ☐ INTERPRETATION

is Described Below or in the Attached: _____

_____
SIGNATURE

ATTACHMENT: _____

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

SHOP DRAWING / SUBMITTAL LOG AND CONTROL SHEET

Project:
Project No:
PAGE _____ OF _____

Owner:
Contractor:
Engineer: Jones Edmunds & Associates

Project Manager:
Project Manager:
Project Manager:

Contractor Submittal No.	Jones Edmunds Submittal No.	Description	Specification Section	CC / Date	Originals # Copies Received	Originals Date Received	To Reviewer Date	To QA/QC Date	To Const. Manager Date	ACTION					Transmitted to Contractor By and Date	Number of Copies Returned	Transmitted Via	Remarks
										Approved	Not Approved	Return for Correction	Approved As Noted	For Info. Only				
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Resubmittal	Resubmittal																	
Resubmittal	Resubmittal																	
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Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

SHOP DRAWING/SUBMITTAL CONTROL FORM

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

CONTRACTOR INFORMATION

SUBMITTAL DATE: _____ SUBMITTAL NUMBER: _____ NO. OF COPIES SENT: _____

☐ ORIGINAL SUBMITTAL ☐ RESUBMITTAL ☐ SUPPLEMENT ☐ INFORMATION ONLY

NOTE: If other than original then include: Date of Original _____ Submittal No. of Original _____

A. SPECIFICATION SECTION AND SUB-SECTION NUMBER: _____

B. DESCRIPTION: _____

C. MANUFACTURED BY: _____ INSTALLED BY: _____

The above referenced submittal has been reviewed by the undersigned and I/we certify that the material and/or equipment meets or exceeds the project specification requirements with:

☐ NO DEVIATIONS ☐ A COMPLETE LIST OF DEVIATIONS AS FOLLOWS[a]

_____

_____

[a]Any deviations not brought to the attention of the Engineer for review and concurrence shall be the responsibility of the Contractor to correct, if required by Engineer.

ENGINEER INFORMATION

NO. OF COPIES RECEIVED _____ NO. OF COPIES RETURNED _____

ACTIVITY	DATE	PERSON	COMMENT
RECEIVED			
RETURNED			

SUBMITTAL REVIEW

REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT AND COMPLIANCE WITH INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS, QUANTITIES, OR INSTALLATION REQUIREMENTS.

☐ NO EXCEPTIONS NOTED ☐ MAKE CORRECTIONS NOTED ☐ AMEND AND RESUBMIT ☐ REJECTED—SEE REMARKS

☐ FOR INFORMATION ONLY ☐ COMMENTS ATTACHED Signed: _____

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

NOTICE OF NONCOMPLIANCE (NON) No. ____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

TO: _____ DATE: _____
_____ TIME: _____

NONCOMPLIANCE OBSERVATION: _____

DETAILS OF OBSERVATION: _____

REFERENCE TO CONTRACT DOCUMENTS: _____

Your response to this notice is required by the close of business on the day following the date of issuance.

Receipt of the above notice of noncompliance is hereby acknowledged by:

_____

THIS THE _____ DAY OF _____, 20____

BY:

TITLE: _____ _____
CONTRACTOR'S REPRESENTATIVE RESIDENT PROJECT REPRESENTATIVE

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

CERTIFICATE OF GUARANTEE

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

DESCRIPTION OF WORK: _____

DATE OF ISSUANCE: _____

The Work under the Contract, except as expressly excluded, and all of its subcontracts, severally and collectively, whether herein stipulated in each case or not, shall be guaranteed against faulty workmanship and/or material as specified below from date of acceptance of the work. The provisions of the guarantee and/or guarantees shall be incumbent on all parties of the work, including the Contractor, each subcontractor, all material supply houses and all manufacturers whose products and/or equipment are incorporated into the facilities.

Neither the Certificate of Substantial Completion, Final Certificate of Payment, nor any provision in the Contract Documents, nor partial or entire use or occupancy of the premises by the Owner shall constitute an acceptance of work, materials, or equipment not performed or installed in accordance with the Contract Documents, or relieve the Contractor or his Sureties of liability in respect to any warranties or responsibility for faulty materials or workmanship.

The Contractor shall guarantee all materials and equipment furnished and work performed for a period of one (1) 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 or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system resulting from such defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other work that may be necessary by such defects, the Owner may do so and charge the Contractor the cost thereby incurred. The Maintenance Bond shall remain in full force and effect through the guarantee period.

CONTRACTOR	BY	DATE

Jones Edmunds & Associates, Inc.

ENGINEER	BY	DATE

OWNER	BY	DATE

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

WORK CHANGE DIRECTIVE NO. _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

DATE OF ISSUANCE: _____ EFFECTIVE DATE: _____

Contractor is directed to proceed promptly with the following change(s):

ITEM NO.	DESCRIPTION
1	
2	
3	

ATTACHMENTS

_____

_____

PURPOSE FOR WORK CHANGE DIRECTIVE:

Authorization for Work described herein to proceed on the basis of Cost of the Work due to:

☐ Non-agreement on pricing of proposed change.

☐ Necessity to expedite Work described herein before agreeing to changes on Contract Price and Contract Time.

☐ Other: _____

ESTIMATED CHANGE IN CONTRACT PRICE AND CONTRACT TIME:

Contract Price: $ _____ (increase/decrease) Contract Time (days): _____ (increase/decrease)

_____ _____
ENGINEER SIGNATURE *DATE*

_____ _____
OWNER REPRESENTATIVE SIGNATURE *DATE*

_____ _____
CONTRACTOR REPRESENTATIVE SIGNATURE *DATE*

_____ _____
FUNDING AGENCY SIGNATURE
(if applicable) *DATE*

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

CONSTRUCTION FIELD ORDER (CFO) NO. _____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

DATE OF ISSUANCE: _____ EFFECTIVE DATE: _____

SPECIFICATION SECTION REFERENCE: _____

DRAWINGS / DETAILS REFERENCE: _____

ATTENTION: You are hereby directed to promptly execute this Construction Field Order, for minor changes in the Work without changes in Contract Price or Contract Time. If you consider that a change in Contract Price or Contract Time is required, please notify the Engineer within **7 days** and before proceeding with this Work.

DESCRIPTION AND REASON FOR CHANGE

_____

_____

_____

_____

_____

ATTACHMENTS

_____

_____

_____

_____ _____

ENGINEER SIGNATURE *DATE*

Contractor hereby acknowledges receipt of the above Construction Field Order.

_____ _____

CONTRACTOR REPRESENTATIVE SIGNATURE *DATE*

SECTION 00943
CONTRACTOR'S RELEASE

Before me, the undersigned authority, appeared _____ who, being first duly sworn and deposed, says that he is _____of _____, a corporation authorized to do business under the Laws of the State of _____, which is the Contractor on Project No. _____, under a contract with _____, that the said deponent is duly authorized to make this affidavit, 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 _____ 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 any one 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 _____ simultaneously with the making of this affidavit constitutes all claims and demands against _____ on account of said contract or otherwise, and that acceptance of the sum specified in said final estimate will operate as a full and final release and discharge of _____ from any further claims, demands, or compensation by the Contractor under the above contract. Deponent further agrees that all guarantees under this contract shall start and be in full force from the date of this release as spelled out in the contract documents.

_____
(Contractor's Officer)

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

_____
(Notary Public)

My Commission Expires _____

(Seal)

SECTION 00944
SURETY'S RELEASE FOR FINAL PAYMENT

CONTRACTOR: _____ **CONTRACT:** _____

We, the _____, having therefore executed a performance bond for the above-named contractor covering the project and section as described above in the sum of _____, (_____), hereby agree that _____ 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 _____ to make payment of the final estimate to said contractor and/or his assignee, shall in no wise relieve this 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 on this _____ day of _____ A.D. 20_____.

_____
Surety Company

(Power of Attorney must be attached if executed by attorney in fact.)

By:_____

STATE OF _____
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 _____, as its_____ and the said _____ acknowledged that he executed said instrument in the name of _____, as its _____ and/or _____ for the purposes 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 hereto set my hand and official seal at _____ this _____ day of _____, A.D. 20_____.

_____
(Notary Public)

My Commission Expires _____

(Seal)

Gainesville | Jacksonville | Tampa | Titusville
Sarasota | West Palm Beach | Winter Haven

JonesEdmunds

PROPOSED CONTRACT MODIFICATION (PCM) No. ____

OWNER/CLIENT: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

ENGINEER: Jones Edmunds & Associates, Inc. PROJECT NO.: _____ PROJECT MANAGER: _____

CONTRACTOR: _____ PROJECT NO.: _____ PROJECT MANAGER: _____

PROJECT NAME: _____

TO: _____ DATE: _____

_____

_____

_____

Please submit your proposal for an equitable adjustment in the contract amount and/or performance time in accordance with the following:

CONTRACT DOCUMENT REFERENCE(S): _____

_____

DESCRIPTION OF MODIFICATION: _____

_____

REASON FOR MODIFICATION: _____

_____

WORK DIRECTIVE:

☐ Proceed with the work immediately.

☐ Do not proceed with the work until a change order is issued.

Your response is requested by _____

xc:

SIGNATURE: _____

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01000
PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Owner – The term *Owner* when used in the Technical Specifications refers to the entity with whom the Contractor has entered into the Agreement for this project and for whom the Work is to be performed. The term *Owner* also encompasses representatives of the Owner including the Engineer.

1.02 SCOPE OF WORK

A. 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 01100, Summary of Work.

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. 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 Owner 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 Owner, 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 Owner 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, cable, fiber optic, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

   a. 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.
   b. 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.
   c. 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.
   d. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the Work and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Owner, 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 Owner, 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.

e. At all times in performance of the Work the Contractor shall 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 cooperate fully with the owners thereof to that end.

f. The Contractor shall give written notice to the 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.

g. 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.

1.03 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 Owner, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes that may be required, the Owner will prepare drawings known as Supplementary Drawings, with specifications pertaining to such Drawings, and the Contractor will be furnished one complete set of reproducible black-line prints (22 inches by 34 inches) and one reproducible copy of the specifications, or alternatively may be provided electronic files in PDF format, at the Owner's option.
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 Owner, and shall notify the Owner 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 Owner should such errors or omissions be discovered.
2. All schedules are given for the convenience of the Owner and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for making estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under the Contract.

D. Specifications: The Technical Specifications each consist of three parts: General, Products, and Execution. The General part of a Specification contains General Requirements that 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.

1.04 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 Owner's option, that the manufacturer or subcontractor deal directly with the Owner. Any such transactions shall not in any way release the Contractor from his full responsibilities under this Contract.
2. Any two 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 to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries to avoid delay in or impediment of the progress of the work of any related Contractor.

C. Tools and Accessories

1. Unless otherwise stated in the Contract Documents, the Contractor shall furnish each type, kind, or size of equipment one complete set of suitably marked high-grade special tools and appliances that 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 help the Contractor, when required, 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 Contractor, the manufacturer's engineer or superintendent shall make all adjustments and tests required by the Owner to prove that the 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.

1.05 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 copies of the reports shall be submitted, or quantity as required by the Owner, and authoritative certification thereof must be furnished to the Owner as a prerequisite for the acceptance of any material or equipment.
2. If, in the making of any test of any material or equipment, the Owner ascertains 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 that may occur to the equipment before the time when the Owner formally takes over the operation thereof.

B. Costs

1. The Contractor shall provide all inspection and testing of materials furnished under this Contract, unless otherwise expressly specified.
2. The Contractor shall bear the cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents, and such costs shall be deemed to be included in the Contract Price.
3. The Owner may test materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment that are rejected for non-compliance.

C. Certificate of Manufacture

1. The Contractor shall furnish the Owner with 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 that shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. Five copies of the manufacturer's actual test data and interpreted results thereof, or quantity as required by the Owner, 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 Owner for approval.
3. The Contractor shall bear the cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment.

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 that does not comply with the requirements of the Contract Documents, the Contractor shall, before 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. Before the 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. The Contractor shall assist in the demonstration tests as applicable.

1.06 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 Owner. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Contractor shall establish benchmarks and coordination points using Surveys where provided in the Contract Drawings. Where not provided in the Contract Drawings, the benchmarks and coordination points shall be established by the Contractor at no additional cost to the Owner. 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 place excavation and other materials so as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions he places contrary to this provision.

B. Surveys

1. At his own expense, the Contractor shall furnish and maintain 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 Owner's attention to any inaccuracies.
3. At his own expense, the Contractor shall establish all working or construction lines and grades as required from the reference marks set by the Contractor and shall be solely responsible for the accuracy of these lines and grades. He shall, however, be subject to check and review by the Owner.

C. Safeguarding Marks

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks 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 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 they are disturbed or destroyed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01100
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

Unless otherwise expressly provided in the Contract Documents, the Work must be performed in accordance with best modern practice, with materials and workmanship of the highest quality to the satisfaction of the Owner.

A. The Project title is Columbia County North Florida Mega Industrial Park Wastewater Treatment Plant.

B. The Work of this Project shall be performed in accordance with the Contract Documents and generally includes, but is not limited to, construction of a four-stage, 0.5-million-gallon-per-day (MGD) annual average daily flow (AADF) Wastewater Treatment Plant consisting of the following:

1. New influent pump station with master manhole.
2. Headworks (rotary drum screen and shaftless screw conveyor).
3. Four-stage field-erected package treatment plant (including equalization basin and digester basin) with addition of pumps, airlifts, positive displacement blowers, and diffusers.
4. Sludge-loading pump station.
5. Leachate storage tanks and pump stations with positive displacement blowers and truck loading pumps.
6. Chlorine contract basin with transfer pump station.
7. Chemical feed and storage facilities with analyzer facility.
8. Plant drain pump station with collection system.
9. Electrical motor control center (MCC) and administration buildings.
10. Effluent storage pond.
11. Access road with utilities.
12. Associated sitework, civil, grading, plant roadway, drainage, stormwater pond, sprayfield, gates, fencing, and other miscellaneous structures.
13. Associated yard piping, meters, valves, backflow preventers, samplers, and other appurtenances.
14. Associated electrical and instrumentation including backup generator and fuel storage tank.

C. The Specification Divisions and Drawings are an integrated part of the Contract Documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The Drawings and Specifications establish

minimum standards of quality for this project. They do not purport to cover all details entering into the design and construction of materials and equipment.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Association of State Highway and Transportation Officials (AASHTO) Formerly (AASHO)
B. American Concrete Institute (ACI)
C. American Institute of Steel Construction (AISC)
D. American Iron and Steel Institute (AISI)
E. American National Standards Institute (ANSI)
F. American Standards Association (ASA)
G. American Society of Mechanical Engineers (ASME)
H. American Society of Testing and Material (ASTM)
I. American Water Works Association (AWWA)
J. American Welding Society (AWS)
K. Anti-Friction Bearing Manufacturer's Association (AFBMA)
L. Building Officials and Code Administrators International, Inc. (BOCA)
M. Construction Specifications Institute (CSI)
N. Federal Specification (FS)
O. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)
P. FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)
Q. Geosynthetics Institute (GSI)
R. National Bureau of Standards (NBS)
S. National Electrical Manufacturer's Association (NEMA)
T. National Fire Protection Association (NFPA)
U. Portland Cement Association (PCA)
V. Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)
W. Steel Structures Painting Council (SSPC)
X. Southern Standard Building Code (SSBC)
Y. Underwriters' Laboratories, Inc. (UL)
Z. United States of America Standards Institute (USASI)
AA. Regulations of Florida Industrial Commission Regarding Safety
BB. All local, state, county, or municipal building codes requirements of the Owner's Insurance

1.03 GENERAL REQUIREMENTS

A. Unless otherwise specified on the Construction Drawings or Specifications, all work and the quality of materials shall conform to the referenced sections of the FDOT *Standard Specifications for Road and Bridge Construction, Supplementary Specifications*, and *Roadway and Traffic Design Standards*. The Contractor shall retain on the job site copies of these standard FDOT documents. The basis of payment shall conform to Section 01200, Measurement and Payment, of the General Requirements.

1.04 WORKING HOURS

A. Normal working hours shall be between the hours of 7:00 AM to 5:00 PM or as indicated in Section 01735, Control of Work.

B. Work under this contract shall not be prosecuted on Sundays or on State and/or National holidays, except in time of emergency, and then only under written permission from the Owner who shall be the sole judge as to the urgency of that situation. On weekdays and Saturdays, the workday shall be limited to daylight hours.

C. If the Contractor deems it necessary to work on Sundays, holidays, or beyond daylight hours to comply with his construction schedule or because of an emergency, the Contractor shall request permission of the Owner to do so. If, in the opinion of the Owner, the need is bona fide, the Owner will authorize the Contractor to work such hours as may be necessary.

1.05 REIMBURSEMENT FEES

A. The following rates shall be applied as the Owner's reimbursement of the Engineer's fee to be paid by the Contractor for expenses defined in Supplementary Conditions SC-6.02.C, SC-6.05.A.2.f, SC-6.17.E.2, SC-9.05.B, and SC-13.03.A.

1.	Senior Field Representative (Construction):	$	105
2.	Senior Construction Administrator:	$	160
3.	Engineering Consultant (Senior Project Manager):	$	230
4.	Project Engineer	$	185
5.	Senior CADD/Designer	$	115
6.	Administrative Assistant:	$	95

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers methods of measurement and payment for items of work under this Contract.

B. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work including furnishing all materials, equipment, and tools and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum Bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary/ ancillary obligation of the Contractor and all costs in connection with these subsidiary/ancillary obligations shall be included in the Bid(s) to provide a complete and functional Project.

1.02 EXCAVATION, TRENCHING, AND CLEARING

A. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, disposal of surplus excavated material, handling water (and groundwater), and purchasing and hauling of required fill material. All excavation and trenching shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth, unless otherwise stated.

1.03 LUMP SUM

A. For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Owner at the final completion of the Project.

1.04 UNIT PRICE

A. For unit price items, payment shall be made based on the actual amount of work accepted by the Owner and for the actual amount of materials in place at the final completion of the Project, as confirmed by the final measurements.

B. After the work is completed and before final payment is made, the Engineer shall make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

1.05 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract unit price multiplied by the actual quantities of work constructed and accepted by the Owner at the completion of the project.

B. The actual percentage of each lump-sum bid item completed by the Contractor and accepted by the Owner at the final completion of the Project will be paid to the Contractor.

1.06 DELETED ITEMS

A. Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

1.07 PARTIAL PAYMENTS

A. Partial payments shall be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the General and Supplementary Conditions.

1.08 PAYMENT FOR STORED MATERIAL DELIVERED TO THE PROJECT

A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Owner. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage

requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.

B. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than $2,500 shall not be compensated for as a stored material item.

1.09 FINAL PAYMENT

A. If requested by the Engineer, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Engineer. The field verification shall be made in the presence of the Engineer and agreed to by both the Engineer and the Contractor. The Engineer will prepare a final adjusting Change Order that will adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Owner and for which the Contractor will be compensated.

1.10 SCHEDULE OF VALUES

A. A schedule of values for the lump-sum bid items and some of the unit-price bid items as required by the Engineer shall be submitted and accepted before the first pay request is approved by the Engineer. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Engineer can more accurately review and approve the Contractor's pay application for the completed work.

1.11 MISCELLANEOUS CONSTRUCTION ITEMS

A. When pipe/service lines are constructed across an existing road, the road shall not be cut to perform this construction unless authorized in writing by the Engineer. Service lines are to be bored, jack and bored, or horizontally directionally drilled (HDD) under the road. Jetting of water lines or water service lines will not be allowed.

B. The Contractor shall take all precautions necessary to locate and protect existing utilities, roads, and miscellaneous items from damage during construction.

C. The Contractor shall repair, relocate, or replace existing utilities, roadways, and miscellaneous items to pre-construction conditions.

D. All repairs, relocations, and replacements necessary are considered incidental to the work and will be at the Contractor's cost, with no cost to the Owner.

E. The unit-price bid items and lump-sum bid items for all pipe items shall constitute full compensation for furnishing, laying, jointing, and testing of pipe; dewatering; excavation and backfill; replacing damaged vegetation; and cleanup. All pipelines including but not limited to sewer lines, water lines, force mains, and gravity sewer lines, which are to be paid for per linear foot in the Bid Schedule, will be measured for payment only on a horizontal plane after installation, unless otherwise noted.

F. Payment for the water services, fire hydrants, and isolation valve bid items shall not be made until the associated Water Service Cards, Fire Hydrant Cards, and Isolation Valve Cards have been properly filled out, signed by the Contractor, and accepted by the Engineer as completed installations. Samples of the Water Service Card, Fire Hydrant Card, and Isolation Valve Card are located at the end of Section 15110, Manual, Check, and Process Valves. The Contractor shall make all required copies of the cards for use in the work.

G. The Contractor shall have the Engineer observe and document the installation of each underground fitting on the project. If the installation of any fitting is not confirmed and documented by the Engineer, it shall not be paid for by the Owner.

PART 2 PAY ITEM DESCRIPTIONS

2.01 BID –

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major work scope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are not fully representative nor all-inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

Item 1. Mob, Demob, and General Conditions – This item shall include and cover the costs for performing construction, preparatory, and overhead operations including but not limited to movement of personnel and equipment to and from the site; temporary sanitary facilities; project administration and management; insurance; bonds; Owner and Engineer indemnification; temporary utilities; permits related to construction; establishing, maintaining, and monitoring a complete and comprehensive site health and safety program during the execution of the Construction Contract that complies with all local, state, and federal safety guidelines and laws; and all other similar activities and facilities necessary for executing this project. Health and safety is the sole responsibility of the Contractor. The Engineer will only be responsible for the safety of his personnel

and facilities. This item shall not exceed 8% of the Base Bid amount. The Contractor shall be paid 20% of this item upon completion of mobilization and 10% upon demobilization; the remainder will be prorated equally over the construction period.

Item 2. Environmental Protection – This item shall include but not be limited to all costs for providing a comprehensive environmental protection program for the project site and other areas that may be affected by the construction. This includes providing labor and materials necessary to prevent environmental damage to the ground, water, and air in conformance with all local, state, and federal laws. Examples include control of stormwater, erodible soils, noise, dust, pollutants, trash, waste, pumping discharge, and any other substance or activity that may adversely impact the environment. The Contractor will be paid 40% upon delivery and set-up of the materials, and the remainder will be prorated equally over the construction period.

Item 3. Wastewater Treatment Plant (WWTP) – The Contractor shall furnish all labor, materials, equipment, and services necessary to construct the WWTP. This item includes all work within the WWTP property including but not limited to site work, grading, drainage, stormwater pond, reclaimed water storage pond, seeding and sodding, roadways, influent pumping station, 4-stage biological nutrient removal package treatment plant, leachate pumping and storage tanks, transfer pump stations, electrical/motor control center (MCC) and administration buildings, chlorine contact basins, chemical storage and feed systems, plant drain pumping station, sludge truck pump station, yard piping, effluent storage pond, site electrical and instrumentation, manholes, valves, meters, samplers, pumps, and any other associated appurtenances. All work required for completing the project not included in other pay items shall be included in this pay item. Payment for this item shall be made based on percent complete in accordance with the Contractor's approved Schedule of Values and upon Engineer verification.

Item 4. Miscellaneous Concrete – The Contractor shall furnish all labor, materials, equipment, and services necessary to place/install concrete for pipe encasements, pipe cradles, and other miscellaneous concrete at the direction of the Engineer. No payment will be made for concrete used to correct faulty work. The Contractor will be paid per cubic yard for the miscellaneous formed and reinforced concrete installed complete. The cubic yard measure will be measured in place.

Item 5. Testing Allowance – This allowance is for paying for invoices for geotechnical in-place density testing of soils and pavement, concrete cylinder testing, and other testing as required by the Engineer and as specified in the Contract Documents. Only the amount properly documented by the Contractor and

authorized by the Engineer will be paid to the Contractor. The Contractor shall not request any additional payment above the approved laboratory's invoice amounts. If the Contractor has any cost associated with this bid item, it shall be included in the other (non-allowance) bid unit price items. Failed tests will not be compensated for. Payment for this item will be in accordance with the allowance sections of the General and Supplementary Conditions.

Item 6. Record Drawings – This item includes all costs for providing the services of a Professional Land Surveyor to perform pre-construction stakeout; establish vertical control, horizontal control, rights-of-way locations, and property boundary locations; and verify and certify Record Drawing information in accordance with the Contract Documents and to the satisfaction of the Owner. The Contractor shall furnish all labor, materials, equipment, and services for composing and providing Record Drawings for the entire project in accordance with the Contract Documents including but not limited to updating the electronic copy of the Drawings, identifying items that were revised during the project or addenda, having all Survey Drawings signed and sealed by a Florida-certified Professional Land Surveyor, and Record Drawings signed and sealed by a Florida-licensed Professional Engineer. Provide three signed-and-sealed paper copies of the Record Drawings. The Contractor shall be paid 40% upon initial project layout and 10% upon completion of the Record Drawings, and the remainder will be prorated equally over the duration of construction when determined by the Engineer to be complete according to the Contract Document requirements.

2.02 BID ALTERNATE

Item A.1. Plant Access Roadway – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to the plant access roadway. This item includes the roadway components as defined in the Contract Drawings and associated drainage and assorted facilities. This would be the entirety of the "Typical 12' Gravel Road" as indicated in the Civil Drawings and would not include any portions of the asphalt roadway.

Item A.2. Pipes Along Plant Access Roadway – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to tying in 8-inch potable water and 6-inch sanitary sewer from along US 90 and route them 0.6 mile south along the access road to the proposed WWTP. This includes all pipe, fittings, valves, and associated appurtenances on both of these lines.
The potable water line shall be from the connection at US 90 to the southern end of the WWTP (approximate stations 10+35 through 42+00 on Civil Drawings)

and shall only extend laterally to the extent of the tee and valve shown on the Civil Drawings. The valve shall be the connection point for the base bid. The 6-inch sanitary sewer shall be from the connection at US 90 to the connection at the influent master manhole (approximate stations 10+35 through 31+55 on Civil Drawings).

Item A.3. Future Pipes Along Plant Access Roadway – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to installing, plugging, and capping a future 12-inch pipeline without tying it into any structures or existing piping. The piping would be routed parallel to the force main in Item A.2 from along US 90 and route them 0.6 mile south along the access road to the proposed WWTP. This would include all pipe, fittings, valves, and associated appurtenances. The 12-inch pipeline shall be from US 90 to the influent master manhole (approximate stations 10+35 through 31+55 on Civil Drawings). The pipe shall be pressure tested and shall remain restrained, capped, and filled with water following approved pressure test.

Item A.4. Electrical Along Plant Access Roadway – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to tying electrical power and telecom cable services from along US 90 and route them 0.6 mile south along the access road to the proposed WWTP. This includes all cabling, pull boxes, and associated appurtenances.

Item A.5a. Piping to Sprayfield (HDPE) – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to installing approximately 1.2 miles of HDPE piping from the proposed WWTP to the extents of the sprayfield. The piping shall be from the North/South portion of piping in the easement east of the Chlorine Contract Chamber through the East/West portion of piping just before the header running North/South. This includes all pipe, fittings, valves, and associated appurtenances.

Item A.5b. Piping to Sprayfield (PVC) – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to installing approximately 1.2 miles of PVC piping in place of the HDPE piping from the proposed WWTP to the extents of the sprayfield The piping shall be from the North/South portion of piping in the easement east of the Chlorine Contract Chamber through the East/West portion of piping just before the header running North/South. This includes all pipe, fittings, valves, PVC-to-HDPE adapters and associated appurtenances.

Item A.6. Sprayfield – Cost for the lump-sum bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, and equipment services related to constructing the sprayfields with associated piping and headers. This item includes, but is not limited to, ARV stations, sprayfield discharge headers, diffusers, earthwork, excavation, backfill, compaction, loading, hauling, disposal of soil, seeding and sodding, surface restoration, and all other work required for the Contractor to construct the sprayfields as indicated in the Contract Drawings.

END OF SECTION

SECTION 01290
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. To the Owner, a proposed Schedule of Values allocated to the various portions of the Work, in accordance with Section 01000, Project Requirements, and Section 01200, Measurement and Payment.

B. Upon request of the Owner, supporting data that will substantiate the values' correctness.

C. The accepted Schedule of Values shall be used as the basis for the Contractor's Applications for Payment.

D. An update and resubmittal of the Schedule of Values when Change Orders affect the listing or when the actual performance of the Work involves necessary changes of substance to values previously listed and approved.

E. Schedule of Values

1. Submit typed schedule on EJCDC 1910-8-E forms or another format as may be approved by the Owner.
2. Submit Schedule of Values in PDF format via Owner-approved electronic transmittal method or on CD, or as duplicate hardcopies, within 10 days after the date of Owner-Contractor Agreement.
3. Format – Use the schedule of prices in the Bid Proposal. Show the cost breakdown for each lump-sum item. The lump-sum breakdown shall, at a minimum, use the Table of Contents of this manual outline. Identify each line item with the number and title of the major Specification Section. Identify site mobilization and demobilization, bonds and insurance, submittals, equipment procurement, installation, warranty, startup, Record Drawings, photographs, and operations and maintenance manuals, etc.
4. Revise the schedule to list approved Change Orders with each Application for Payment.

1.02 CASH ALLOWANCES

A. Costs Included in Allowances - The cost of the product to the Contractor or subcontractor, less applicable trade discounts and applicable taxes.

B. Costs Not Included in the Allowance but are included in the Contract Price - Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Contractor Responsibilities

1. Execute purchase agreement with designated supplier.
2. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
3. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Differences between allowance amounts and actual costs will be adjusted by Change Order before final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
CONSTRUCTION COORDINATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall coordinate Work with that of other construction projects as needed.

B. Before starting Work and from time to time as the Work progresses, the Contractor and each subcontractor shall examine the work and materials installed by others as it applies to its own work and shall notify the Engineer immediately in writing if any conditions exist which will prevent satisfactory results in the installation of the system. Should the Contractor or subcontractor start work without such notification, it shall be construed as an acceptance of all claims or questions as to the suitability of the work of others to receive its Work. The Contractor shall remove and/or replace, at its own expense, all work under this Contract that may have to be removed on account of such defects or omissions.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The Contractor shall ensure that all drawing, product data, and samples comply with Contract Documents and field dimensions and clearances.

B. The Contractor shall submit requests for interpretation of Contract Documents in a timely fashion to ensure there are no disruptions with the Work as scheduled. Obtain instructions through the Engineer to resolve all queries.

C. Process requests for substitutions and Change Orders through the Engineer.

D. Deliver close-out submittals to the Engineer.

1.03 WORK SEQUENCE

A. The Contractor shall submit a preliminary Progress Schedule, in accordance with Section 01320, Progress Schedule, to the Engineer. After review, the Contractor shall revise and resubmit the Progress Schedule to comply with requested revisions.

1.04 CONSTRUCTION MOBILIZATION

The Contractor shall do the following:

A. Cooperate with the Owner in allocating mobilization areas on site for field offices and sheds, access, traffic, and parking facilities. During construction, the Contractor shall coordinate the use of the site and facilities through the Engineer.

B. Comply with the Engineer's procedures for intra-project communications: submittals, reports and records, schedules, coordination drawings, recommendations, and resolution of ambiguities/conflicts.

C. Comply with the Engineer’s instructions for use of temporary utilities and construction facilities.

D. Coordinate field engineering and layout work under instructions of the Engineer.

E. Coordinate scheduling, submittals, and work of the various sections of Contract Documents to ensure the efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

F. Coordinate the sequence of Work to accommodate the Owner occupancy as specified in the Contract Documents.

G. In addition to Progress Meetings specified in Section 01320, Progress Schedule, hold pre-construction conferences with personnel and Subcontractors to ensure coordination of Work. The Engineer shall be informed of such meetings and shall be allowed to attend.

H. Coordinate the Work of various sections having interdependent responsibilities for installing equipment, connecting equipment, and placing such equipment in service.

I. Coordinate the use of project space and the sequence of installing civil, architectural, mechanical, structural, instrumentation, systems, and electrical work. Follow practicable routings for pipes, ducts, and conduits, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to maximize accessibility for other installations, maintenance, and repairs.

J. Coordinate Work at existing facilities to minimize disruption of the Owner’s operations.

K. Assemble and coordinate close-out submittals specified in Section 01770, Project Closeout.

1.05 COORDINATION DRAWINGS

A. The Contractor shall provide information required by the Engineer for preparing coordination drawings.

B. The Contractor shall review drawings before submitting them to the Engineer.

1.06 CLOSE-OUT PROCEDURES

The Contractor shall do the following:

A. Notify the Owner when Work is considered ready for Substantial Completion.

B. Comply with the Owner's instructions to correct items of Work listed in executed Certificates of Substantial Completion.

C. Notify the Owner when Work has reached Final Completion.

D. Comply with the Owner's instructions for completing items of Work found incomplete in the Engineer's final inspection.

E. Comply with Section 01770, Project Closeout.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 UTILITIES

A. The Contractor shall coordinate the activities of all utility companies with equipment in the construction area with the Contractor’s and Subcontractor’s Work.

3.02 CUTTING AND PATCHING

A. No cutting and patching of new Work will be accepted. All Work must be new and continuous in its final form.

END OF SECTION

SECTION 01320
PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. All work of this Contract shall be scheduled and monitored by the Contractor using the Critical Path Method (CPM) and shall use the Precedence Diagram Method (PDM) of scheduling. The Contractor shall prepare all schedules and all monthly updates described in this Section. The Contractor will prepare revisions of the schedule to reflect changes in the Contractor's plan of performance or changes in the Work and submit these revisions to the Engineer for acceptance. The Engineer's acceptance of the scheduling documents is to ensure that all CPM Scheduling documents prepared by the Contractor are in conformance with the Contract Documents and Specifications described herein. This acceptance will not impose on the Engineer or Owner the responsibility for the schedule or for the sequencing, scheduling, or progress of the Work, nor will the acceptance interfere with or relieve the Contractor of full responsibility for the schedule and the means, methods, procedures, and sequence of construction.

B. The Contractor shall use the latest version of Primavera Scheduling software, or an approved equal, for all CPM Scheduling applications.

C. The Engineer or Owner may retain the professional services of a CPM Scheduling Consultant to assist in the review and acceptance of the CPM Scheduling documents prepared by the Contractor. Therefore, any reference to the Engineer or Owner within this Section may also indicate the involvement of the Engineer's or Owner's CPM Scheduling Consultant.

D. The Contractor shall prepare and maintain a detailed progress schedule throughout the construction of the Project. The schedule shall be the Contractor's working schedule and be used to plan, organize, and execute the Work, record and report actual performance and progress, and show how the Contractor plans to complete the Work. The schedule will be in the form of an activity-oriented network diagram (CPM).

E. When the Contractor prepares the CPM Schedule and the schedule is accepted by the Engineer, it shall become part of the Contract Documents and will be used by Contractor and Engineer to monitor the progress of the Project. The CPM Schedule may be revised to show changes in the Contractor's method or manner of performance; delays, or authorized changes in the Work. All changes to the schedule will be made in accordance with Article 1.08 of this Section.

F. The Contractor acknowledges that free float belongs to the Owner.

1.02 QUALIFICATIONS

A. To help prepare the detailed CPM Schedule, the Contractor shall engage, at his own expense, a Consultant who is skilled in the time-and-cost application of network techniques for construction projects. If the Contractor has qualified personnel on staff, the Contractor can perform the required scheduling within his own organization.

B. The person performing the CPM scheduling shall have a minimum of 3 years of CPM scheduling experience within the past 5 years on projects of similar size and complexity.

C. Before engaging a Consultant or using in-house staff personnel and within 5 calendar days after Award of Contract, the Contractor shall submit the following to the Engineer:

1. The name and address of the proposed Consultant or employee who will prepare the CPM schedule.
2. Sufficient information to show that the proposed Consultant or employee has the above qualifications including a list of prior construction projects of similar size and complexity, along with selected network samples, which the proposed Consultant or employee has performed. These network samples must show complete project planning similar to that required under this Contract.

D. The Engineer shall have the right to approve or disapprove employment of the proposed Consultant or the performance of the requirements herein by the Contractor's employee and will notify the Contractor of the decision within 7 calendar days from receipt of the information. If the proposed Consultant is rejected, the Contractor shall resubmit another name within 7 calendar days for renewed consideration. Such approval or disapproval does not release the Contractor from his obligations under this Contract.

E. If the Owner or Engineer has reasonable objections to the qualifications of the Contractor's nominated scheduling personnel, the Contractor shall, at no additional cost to the Owner, employ a scheduler whose qualifications comply with the requirements of this Section or employ a qualified subcontractor, subject to review of his qualifications by the Engineer and the Owner.

1.03 PRELIMINARY 90-DAY CPM SCHEDULE

A. The Contractor shall develop a 90-Day CPM Schedule within 10 days after the date indicated in the Notice to Proceed. This schedule shall be a computerized CPM Schedule showing only the early start, early finish of each work activity. The 90-Day Schedule shall contain work activities over the first 90 days, and the estimated durations for each work activity shall be 15 workdays or less. The balance of the job shall be shown in summary log. The 90-Day Schedule shall include but not be limited to site work, hazardous material removal, demolition, key procurement activities (i.e. submissions, approvals, fabrication, and delivery), equipment, mechanical, electrical, and plumbing coordination and any other work that will occur during the first 90 days. This 90-Day Schedule shall become part of the Detailed CPM Schedule.

1.04 DEFINITIONS

The following terms used in this Section shall have the following meanings:

A. *Activity.* A fundamental unit of work in a CPM Schedule establishing the time and resources required for performing or furnishing a part of the Work or a requisite step. Each Activity has defined geographical boundaries, time duration in days, and a detailed estimate of resources required to construct the task. Each activity is assigned a unique description, activity number, activity code, and a dollar value.

B. *Record Schedule.* The Record Schedule will have actual start dates and actual finish dates for all work Activities and Milestones necessary to complete the Work.

C. *Baseline Schedule.* The Engineer-accepted Proposed Baseline Schedule. The Baseline Schedule is the Contractor's plan which has been approved by the Engineer for completion of the Work in compliance with the Milestones listed in the Contract Documents and within the Contract Time. The Baseline Schedule may be revised only by the Engineer's approval of a Contractor-produced adjusted Baseline Schedule. The Baseline Schedule for the Work is the sole basis for (a) the monitoring of the Contractor's progress against Milestones and the Contract Time; (b) calculating Total Float or Contract Float; and (c) the evaluation and reconciliation of extensions in Contract Time, if any. The first Baseline Schedule shall be designated by all parties as the Baseline Schedule, Rev. 0. When Baseline Schedules are adjusted by the Contractor and approved by the Engineer, they shall be designated as Baseline Schedule, Rev. 1, 2, 3, etc. (as appropriate) and shall replace the previously approved Baseline Schedule.

D. *Contract Float.* Workdays between the Contractor's expected date for early completion of the Work, or specified part, and the corresponding Contract Time.

E. *CPM Network.* The structure of the computerized schedule. The CPM Network accounts for the entire Work and defines the construction logic in terms of all of the Activities with their logical dependencies.

F. *Critical Path.* A series of Activities linked by dependencies that determine the shortest possible time to complete the Work.

G. *Early Dates.* The early start dates and early finish dates, i.e., the dates each Activity will start and finish if each is started at the earliest end of the range of dates that the CPM indicates the Activities can be performed.

H. *Excusable Delay.* An unforeseeable delay, beyond the control of the Contractor, experienced due to no fault or negligence by the Contractor, its subcontractors, or suppliers.

I. *Free Float.* The amount of time that any activity can be delayed without adversely affecting the early start of the following activity.

J. *Fragnet.* A predefined or individual segment of a network which represents a specified sequence of the Work. Fragnets shall be submitted which include all Activities, required resources, and costs and shall be submitted to the Engineer for approval of all Change Orders before their incorporation into the Baseline Schedule by the Contractor. A Fragnet shall be submitted before approval of any proposed logic changes. Fragnets are banded Activities representing a revised portion of the Baseline Schedule and shall be logically connected and constrained by previously existing predecessor and successor Activities, as applicable.

K. *Late Dates.* The late start dates and the late finish dates; i.e., the dates each Activity will start and finish if each is started at the latest end of the range of dates that the CPM Network indicates the Activities can be performed and still achieve the Milestones and Contract Time.

L. *Milestone.* A point of progress designated for the purpose of establishing start or finish times for a key aspect of the Work.

M. *Predecessor Activity.* An Activity which precedes another Activity (to which it is logically tied) in the CPM Network.

N. *Preliminary Schedule*. The Contractor's Baseline Schedule for the first 180 days of the Contract.

O. *Proposed Baseline Schedule.* The Proposed Baseline Schedule shall represent the Contractor's plan for completion of the Work in compliance with Milestones

listed in the Contract Documents and within the Contract Time. It represents the Contractor's first complete planned schedule submitted for review and approval by the Engineer. The Proposed Baseline Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, utility owners, or the Owner's operations. The Proposed Baseline Schedule shall anticipate all necessary manpower and resources to accomplish activities within the durations set forth in the Proposed Baseline Schedule. The Proposed Baseline Schedule shall address and indicate all submittals required by the Contract and indicate the times allowed for review, resubmittal, and approval of submittals. Upon approval by the Engineer, the first Proposed Baseline Schedule shall become the Baseline Schedule, Rev. 0.

P. *Resource Loading.* The allocation of work force and equipment necessary for the completion of an Activity as scheduled.

Q. *Six-Week Schedule.* A detailed progress schedule taken from the Working Schedule, which discloses the plan for the next 6 weeks' Work and the actual schedule for the previous 6 weeks' Work.

R. *Successor Activity.* An Activity which follows another Activity (to which it is logically tied) in the CPM Network.

S. *Total Float.* The number of workdays by which a part of the Work in the Baseline Schedule or Revised Baseline Schedule may be delayed from its Early Dates without necessarily extending the Contract Time.

T. *Working Schedule.* When the Proposed Baseline Schedule (or a subsequent adjustment is made by the Contractor to the Baseline Schedule) is accepted by the Engineer and becomes the Baseline Schedule, Rev. 0, 1, 2, 3, etc., it shall be duplicated and become the Working Schedule. The Contractor shall update the Working Schedule monthly with a Data Date designated by the Engineer. The Working Schedule shall be updated monthly to reflect actual progress only and shall be the basis for determining monthly progress payments and the Contractor's performance in relation to the most recently approved Baseline Schedule. The Final Working Schedule shall be the Record Schedule.

1.05 DETAILED CPM SCHEDULE

A. The Detailed Network Diagram shall provide sufficient detail and clarity of form and technique so that the Contractor can plan, schedule, and control his work properly and the Engineer can readily monitor and follow the progress for all portions of the Work. The Detailed Network Diagram shall comply with the Contract Times of the Agreement and various limits imposed by the Contract Documents, including required sequencing of portions of the Work described in

Section 01100, Summary of Work. The degree of detail shall be to the satisfaction of the Engineer, but the following factors shall have a bearing on the required depth of activity detail:

1. The structural breakdown of the Project.
2. Project Phasing and/or Milestones.
3. The type of work to be performed and the labor trades involved.
4. All purchase, manufacture, and delivery activities for all major materials and equipment.
5. Maintenance of Facilities in Operation.
6. Submittal and approval of shop drawings and material samples.
7. Plans for all subcontract work.
8. Crew flows and sizes.
9. Assignment of responsibility for performing all activities.
10. Access and availability to work areas.
11. Identification of interfaces and dependencies with preceding, concurrent, and follow-on subcontractors and contractors.
12. Testing and start-up of systems.
13. Planning for phased takeover by the Owner.

B. Activities shown shall be in workdays and shall have a maximum duration of 5 days, except in the case of non-construction activities such as procurement of materials and delivery of equipment. All durations shall be the result of definitive manpower and resource planning by the Contractor.

C. The Detailed Network Diagram shall be prepared using a computer plotter.

1.06 COMPUTERIZATION OF THE DETAILED CPM SCHEDULE

A. The mathematical analysis of the Detailed Network Diagram shall be made by computer, and a tabulation for each activity shall include the following:

1. Unique event numbers.
2. Activity descriptions.
3. Durations in workdays for each activity.
4. Earliest start date (by calendar date).
5. Earliest finish date (by calendar date).
6. Latest start day (by calendar date).
7. Latest finish day (by calendar date).
8. Slack or total float in workdays.
9. Percentage of activity completed.

B. The following computer outputs shall be prepared as part of the initial schedule submission and each update thereafter:

1. Activity file sort.
2. Eight-week "Look Ahead" detailed bar chart.
3. Summary bar chart.
4. Additional computer sorts as required by the Owner.
5. CDs of all computer files.
6. Items 1 through 4 above, submit seven copies of each.

1.07 COMPLETION REQUIREMENT

A. The 90-Day Schedule shall be completed within 10 calendar days after the date indicated in the Notice to Proceed.

B. The Detailed CPM Schedule shall be prepared within 30 calendar days after the date indicated in the Notice to Proceed.

C. If the Contractor fails to provide the required CPM scheduling documents to the Engineer within the time prescribed and/or revisions of the scheduling documents within the required time, the Contractor shall be in default of the Contract requirements and the Engineer may withhold approval of progress payments until such time as the Contractor submits the required information.

D. Notwithstanding the implementation of the Progress Schedule, it shall be the sole responsibility of the Contractor to complete the Work within the time of completion required by the Contract.

1.08 UPDATINGS

A. The 90-Day CPM Schedule shall be updated monthly until the Engineer accepts the Detailed CPM Schedule.

B. The first update of the Detailed CPM Schedule shall take place 60 calendar days after the Notice to Proceed with subsequent updates performed monthly at the jobsite for the duration of the contract.

C. The Contractor shall update the Detailed CPM Schedule monthly, using a cutoff/data date agreeable to the Contractor and the Engineer. This cutoff/data date shall be consistent from month to month. The update information shall include but not be limited to the following:

1. Actual start dates.
2. Actual completion dates.

3. Activity percent completion.
4. Remaining duration of activities in progress.

D. The Contractor shall update all the scheduling documents and submit these documents to the Engineer within 5 workdays of the cutoff/data date.

E. The Contractor shall submit seven copies of the CPM schedule and one electronic copy of the CPM schedule on a CD.

F. As part of the normal CPM update, the Contractor shall prepare a written narrative report highlighting the progress during the past update period. The written narrative report shall include but not be limited to the following information:

1. Summary of work accomplished during the past update period.
2. Milestone Comparison Chart.
3. Analysis of Critical Path(s).
4. Analysis of Secondary Critical Path(s). Secondary Critical Path is defined as float within 10 workdays of Critical Path.
5. Analysis of time lost/gained during the update period.
6. Identification of problem areas.
7. Identification of change orders and/or any delay that is impacting/delaying the project schedule.
8. Solutions to current problems.

G. The Contractor is required to attend and participate in a CPM update review meeting with the Engineer. Attendance is mandatory. This meeting will take place 7 workdays after the cutoff/data date, or during progress meetings as decided by the Owner and the Engineer. The purpose of this meeting is to review past progress, current status, problem areas, and future progress. The Contractor's narrative report will be reviewed at this meeting.

H. All schedule update information outlined above will be reviewed and accepted by the Engineer.

1.09 RECOVERY SCHEDULE

A. If the Contractor fails to achieve the planned progress, as indicated in the approved/updated detailed CPM Schedule, and the Contractor's lack of progress delays the Critical path and/or an intermediate milestone by more than 10 workdays (monthly or cumulatively), the Contractor shall submit to the Engineer for review and acceptance a proposed Recovery Schedule indicating how the Contractor will recover the time lost.

B. If the Contractor fails to submit a Recovery Schedule and/or fails to cooperate with the Engineer in the Recovery Schedule process, the Owner can immediately order the Contractor to accelerate completion of the late activities which have been delayed by whatever means necessary without any additional costs to the Owner. The Owner can withhold future progress payments until the Contractor's progress is in compliance with the Contract Schedule or until the Owner has approved by Change Order proposed adjustments to the contract milestones, extension of contract time, or modification of the Contract Schedule.

1.10 CHANGE ORDERS, DELAYS AND EXTENSIONS OF TIME

A. When proposed Change Orders, approved Change Orders, or any delays are experienced and the Contractor believes the Change Order/Delay is causing delay to an intermediate contract milestone or to the project completion, the Contractor shall submit to the Engineer a Time Impact Analysis, explaining the influence of each Change Order/Delay on the current updated Contract CPM Schedule. The Contractor shall prepare a "Fragnet" (network analysis) of each Change Order/Delay on the current updated Contract CPM Schedule. The analysis will demonstrate the time impact based on the date the change is given to the Contractor, the status of construction at that point in time, and the event time computation of all affected activities. The event times used in the analysis shall be those included in the latest updated copy of the detailed CPM Schedule closest to the time of delay or as accepted by the Engineer.

B. For the Contractor to be entitled to an extension of Contract time to an intermediate contract milestone and/or to the project completion, the Time Impact Analysis must show that the Change Order/Delay impacts the intermediate contractual milestone date and/or the updated CPM Schedule's Critical Path, thereby directly impacting the project completion date. Change Orders/Delays that do not impact intermediate contractual milestones and/or the critical path and impact activities with float will not be considered as a delay to the project and no extension of time will be granted.

C. The Contractor must submit a written analysis within 7 calendar days after a delay occurs or authorized change in work is given to the Contractor. If the Contractor does not submit a written analysis for specific Change Order(s) or Delay(s) within the specified period of time, then it is mutually agreed that the particular Change Order of Delay has no time impact on the Project CPM Schedule and no time extension is required.

D. The Engineer will accept or reject each Time Impact Analysis within 14 calendar days after submission unless subsequent meetings and negotiations are necessary. Upon the Engineer's acceptance, the Contractor will incorporate fragnets

illustrating the influence of the Change Orders and Delays into the Detailed CPM Schedule during the first update after agreement is reached.

1.11 PROGRESS MEETINGS

A. The Owner will conduct progress meetings at least once per month to discuss the progress of the Work. The Contractor and any subcontractors the Contractor deems necessary shall attend these meetings. At the Owner's discretion, the frequency of the meetings may be increased if the progress of the Work is not satisfactory or if coordination problems should arise.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01325
CONSTRUCTION PHOTOS AND VIDEOS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall have digital photos and videos made of the Work from views and at such times as directed by the Owner. The photos and videos shall represent a visual history of the Project, from Contract Award through Contract Completion.

B. The requirements of this Section constitute a minimum requirement, but the Owner may request additional photos or videos at their discretion for complete documentation of the work performed.

C. The Contractor shall also use additional digital photography as necessary to record and facilitate resolution of on-site issues through the transmission of photos by e-mail or other electronic submittal forum from the site to the Owner's offices.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DIGITAL PHOTO REQUIREMENTS

A. Digital photos shall be in color. Provide one copy of each digital photo via electronic submittal to the Owner.

B. Provide photos taken of each of the major items during construction.

C. View and Quantities Required: A minimum of 30 photos per month clearly showing project status and key elements of construction.

D. Deliver digital photos to the Owner on a monthly basis.

E. Photos shall be from locations to illustrate the condition of construction and the state of progress adequately.

F. The Contractor shall provide before and after photos of each portion of the site. The below-ground facilities shall include before, during, and after photos of all equipment, walls, floor, piping, utility crossings, and supports. At major locations,

photos shall include before, during, and after prints all submitted electronically in ascending date order to show the Work as it progresses.

3.02 DIGITAL VIDEO RECORDING REQUIREMENTS

A. The Contractor shall provide to the Owner color digital video of each major facility and structures and facilities adjacent to the construction before construction starts, during construction, and when construction has been completed. Videos shall include the entire site and areas of adjacent properties within 100 feet of the limit of the Work. Special effort shall be made to show the existing improvements and features affected by the work.

B. Approximately every 2 weeks, 10 minutes of digital video shall be submitted to the Owner showing Work completed, Work in progress, Work started, and problems that occurred since the last digital video was made.

C. The Contractor shall maintain the master video of each portion of the facility on the Work site. The master video shall be a running chronicle of construction progress. The Contractor shall combine the bi-weekly video onto the master video.

D. The bi-weekly video shall be submitted to the Owner within 10 working days after recording and the bi-weekly videos may include multiple locations.

E. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate the video, explaining what is being shown, problems that have occurred, and what is being done.

F. All videos shall be delivered to the Owner before Final Completion is submitted.

3.03 AERIAL PHOTOS AND VIDEOS

A. The Contractor shall obtain digital, true-color, aerial photos and aerial videos using aerial drones or other approved means of the entire project site before construction begins, during construction at monthly intervals, and at final completion showing the entire completed construction project.

B. The Contractor is required to secure all permits and approvals from authorities having jurisdiction before any aerial or drone flights and shall have licensed pilots/drone pilots performing the flights in accordance with applicable regulations.

C. Provide a minimum of 20 aerial digital photos from each flight.

D. Aerial videos shall be a minimum of 5 minutes in length or as needed to show the projects from all sides with slow panning, tilting, and/or translating views of the work sites.

E. The Contractor shall submit an aerial photo and video plan to the Owner for approval before conducting the work. The plan shall include a description of the proposed views, lengths of each scene, equipment to be used, schedule, and other relevant information to ensure the Owner's needs are met.

3.04 PHOTO AND VIDEO INFORMATION

A. Each digital photo and video file shall be digitally tagged with the following data or the file name shall be referenced from a log that contains the following information for each photo and video:

1. Digital photo or video digital file name/number.
2. Project name.
3. Contract number.
4. Name of Contractor.
5. Date photo or video was taken.
6. Photographer name.
7. Description of location, view, and construction items the photo displays.

B. All photos and videos shall be clear, unobstructed, sharply focused, and free of distortion.

END OF SECTION

SECTION 01330
SUBMITTALS AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall submit documentation that describes the Work to be performed under the Contract as required in this Section. This documentation will be for the Owner's review and use. The documentation furnished by the Contractor must enable the Owner to verify the Contractor's performance and compliance with Contract requirements. The documentation shall cover all services and deliverables required and secured by the Contract Documents.

1.02 SUBMITTALS

A. General—The Contractor shall submit the following:

1. Project documentation: For the Owner's internal use and shall include all information that will be essential for the facility's operations, maintenance, training, and repair of equipment and facilities supplied by the Contractor. The Contractor shall submit all documentation necessary to ascertain compliance with technical/contractual provisions.
2. Shop drawings: Drawings, schedules, diagrams, warrant, and other data prepared specifically for this Contract by the Contractor or through the Contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor to illustrate a portion of the Work.
3. Product data: Preprinted materials such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the Work, but not prepared exclusively for this Contract.
4. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portions of the Work, illustrating portions of work, or establishing standards for evaluating appearance of finished work or both.
5. Installation Lists: All manufacturers or equipment suppliers who propose to furnish equipment or products shall submit an installation list to the Owner with the required Shop Drawings. The installation list shall include all installations where identical equipment has been installed and has been operating for at least 1 year.
6. Administrative submittals: Data presented for reviews and acceptance to ensure that administrative requirements of the project are adequately met

but not to ensure directly that work is in accordance with the design concept and in compliance with Contract Documents.

B. Coordination

1. Submittals and schedules shall be checked and coordinated with the Work of all trades involved before they are submitted 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.

C. Start of Work

1. Within 30 calendar days after the notice to proceed for the project, the Contractor shall submit to the Owner a Contract Data Requirements List that defines all data to be submitted under this Contract. Included in this list shall be the names of all proposed manufacturers furnishing specified items to the extent known. Review of this list by the Owner shall in no way relieve the Contractor from providing materials, equipment, systems, and structures fully in accordance with the Specifications.

D. General Requirements

1. The Contractor shall prepare, assemble, and submit all documents as described herein. The Contractor shall submit certification that the documents prepared conform to the Contract requirements and will result in a complete and operable project. The Owner shall review the Contractor’s documents for conformance to the Contract requirements and may comment on the documents.
2. The Contractor shall approve and certify all project documents. The Contractor’s failure to certify the documents or failure to provide documents that demonstrate conformance to the Contract requirements are grounds for rejection. The Contractor shall be responsible for and bear all costs for proceeding with any part of the Work that fails to meet the Contract requirements.
3. Submittal of documents for the Owner’s review shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated Work (system/equipment/facilities) that comply with these Contract documents.

E. Requests for Substitution

1. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of

design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:

a. Principle of operation.
b. Materials of construction or finishes.
c. Thickness or gauge of materials.
d. Weight of item.
e. Deleted features or items.
f. Added features or items.
g. Changes in other work caused by the substitution.
h. If the substitution contains differences or omissions not specifically called to the attention of the Owner, the Owner reserves the right to require equal or similar features to be added to the substituted product at the Contractor's expense.

F. Submittal Requirements and Procedures

1. Drawing Formats and Requirements

a. Drawings—All Drawings and Shop Drawings shall be prepared in 11-x-17-inch or larger format and shall have a blank area of 3 x 4 inches in the lower right-hand corner above the title block. Each Drawing shall indicate the following information in the title block:

(1) Title and Drawing Number.
(2) Date of Drawing or Revision.
(3) Name of Building or Facility.
(4) Name of Contractor or subcontractor.
(5) Drawing contents and locations.
(6) Specification Section and Subsection Numbers.

b. All drawings shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

2. Product Data:

a. Requirements—Product data shall include all catalog cuts, performance surveys, test reports, equipment lists, material lists, diagrams, pictures, and descriptive material. All product data shall be submitted in either 8.5-x-11-inch or 11-x-17-inch size formats. The submittal information shall show the standard and optional

product features, as well as all performance data and specifications. The manufacturer’s recommendation for special tools shall be supplied.

b. All product data shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

3. Samples—The Contractor shall furnish samples required by the Contract Documents, for review by the Owner. Samples shall be delivered to the Owner as specified or directed.

   a. All samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices. The samples shall show the full range of color, texture, and pattern.
   b. The Contractor shall submit a minimum of four samples of items submitted. All samples shall be marked with required submittal information, as specified above.

4. Color, Texture, and Pattern Charts:

   a. The Contractor shall submit color, texture, or pattern charts of all required finishes.
   b. A minimum of four charts of each item shall be submitted.

5. Submittal Information Requirements

   a. When used in the Contract Documents, the term "Submittal Information" shall be considered to mean the following information at a minimum:

      (1) Contract Name.
      (2) Contract Number.
      (3) Location within Facility.
      (4) Date Submitted.

   b. Drawings—The Contractor shall mark submittal information on all Drawings in the left half of the 4-x-3-inch block as described above.

   c. Product Data and Manufacturer's Literature—The Contractor shall mark all product data and manufacturer's literature with submittal information and note which item is being furnished. The Contractor shall mark the option and supplies to be furnished with

the item. Do not submit the manufacturer's general catalog: submit only items being installed or delivered. When manuals are being submitted, the Contractor shall mark submittal information on both the cover and title page. If manuals being submitted contain more than just one item, each item must be marked, and only Contract name and number is to be marked on the cover and title page.

6. Training, Operation and Maintenance Manuals:

a. The Contractor shall submit to the Owner for review and acceptance of manufacturer's installation, operations, lubrication, maintenance, and training manuals for all equipment installed or delivered under this Contract. All manuals shall have submittal information marked on the front cover, title page, and three places inside the manual. If the manual being submitted is for different components, mark the front cover and title page only. Each component section must be marked with the Specification Section and subsection numbers.

b. Operations and Maintenance Manual shall conform to requirements defined in Section 01830, Operations and Maintenance Manuals.

G. Required Submittals

1. Structural Submittals

a. This Section specifies general procedural requirements for contractual submittals for the following structural schedules, product data, samples, and manufacturer's certificates:

(1) Product Data—The Contractor shall provide product data for all architectural and structural items, options, and other data and provide supplemental manufacturer's standard data for information unique to the Work and installation. The submittals shall reflect all items delivered or installed under this Contract.

(2) Samples—The Contractor shall provide all samples required under this Specification including color charts and product samples.

(3) Material, equipment, and installation and demolition Specifications.

2. Mechanical System Submittals

a. This Section specifies general procedural requirements for mechanical schedules, performance data, control diagrams, and other submittal data.

b. The Contractor shall submit the following:

(1) Performance Data.

(2) Finished Data—Complete surface preparation and finished data for all mechanical and electrical unit/subsystems shall be provided, including a complete list of cleaning instructions.

(3) Factory Testing—Detailed description of factory testing procedures, reporting procedures and criteria for test passing or failing shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with the General Requirements and Technical Requirements Sections.

(4) Site (Field) Testing and Acceptance—Detailed description of site testing and acceptance tests including descriptions of procedures, testing equipment, reporting procedures, and criteria for passing or failing tests shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with General Requirements and Technical Requirements.

(5) Factory Test Report—After fabrication and testing, the Contractor shall submit the results of tests. No shipment of any mechanical and electrical unit/subsystem shall be allowed without the written certification from the Contractor that the equipment conforms to the Contract requirements.

(6) Site Test and Acceptance Report—Site test and acceptance reports shall be submitted to the Owner.

(7) Operations and Maintenance Manuals—The Contractor shall furnish manuals for all mechanical and electrical

equipment specified under this Contract. Each manual shall include the following at a minimum:

(a) Description of equipment.
(b) Record shop drawing.
(c) Operation and maintenance instructions.
(d) Part lists.
(e) Equipment ratings.
(f) Valve list.
(g) Lubrication instructions.

H. Submittal Review

1. The Owner's review of the Contractor's documents shall not relieve the Contractor of the responsibility for meeting all of the requirements of the Contract nor of the responsibility for correcting the documents furnished. The Contractor shall have no claim for additional cost or extension in time because of delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract.

2. The Owner will review a submittal or re-submittal once, after which the cost of review shall be borne by the Contractor. The cost of Engineering shall be equal to the Engineer's full cost.

3. No partial submittals will be reviewed. A submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.

4. Documents submitted by the Contractor for approval by the Owner will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:

   a. NO EXCEPTIONS NOTED—This indicates that the submittal appears to comply with the requirements of the performance specifications and that the Work may proceed.
   b. MAKE CORRECTIONS NOTED—This indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
   c. AMEND AND RESUBMIT—This indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.

d. REJECTED—This indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot be modified to gain compliance. A new submittal will be required in the instance of a "reject" status and the Contractor will be cautioned that work may not proceed under this condition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Before submitting documents for the Owner's review, the Contractor shall review the documentation for conformance to the Contract requirements. Submittals shall be complete and comprise a logical division of the Contract Work.

B. All documentation submitted by the Contractor to the Owner shall be accompanied by a letter of transmittal and shall be submitted in a sequence that allows the Owner to have all of the information necessary for checking and accepting a particular document at the time of submittal.

C. Each document shall be identified by a document number, Contract number, Contract name, location, Specification Section, subsection numbers, and submittal date. Where a manual/drawing is revised to reflect a change in design or a change for any other reason, each such revision shall be shown by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid location of the revision, additional notation shall be made in the manual opposite the line or area where the change was made and identified by the corresponding revision number.

3.02 DOCUMENTATION CONTROL AND SUBMITTAL SEQUENCING

A. The Contract Data Requirements List shall be updated and resubmitted to the Owner monthly, throughout the duration of the Contract. This list shall identify the Contractor's submittal number, proposed and actual submittal date, Contract Specification Section Number, Paragraph, Item of the Work, and type of document.

B. The Contractor shall work with the Owner to provide a regulated flow of submittals that allows the Owner to review the submittals in the defined time frame without undue delays. Monthly the Contractor shall provide the Owner a schedule of the approximate quantities and delivery dates for all submittals due for the next 120 days.

3.03 FINAL RECORD DRAWINGS

A. The Contractor shall submit the Final Record Drawing Package to the Owner for review at Substantial Completion or 60 days before Final Completion at the discretion of the Owner. The Contractor shall be provided with CADD files of the Contract Drawings in pdf and AutoCAD, versions specified by the Owner. Final Record Drawings shall be prepared in AutoCAD with the same version used for the Contract Drawings and shall be provided electronically in AutoCAD. The Contractor may request to use a different version, but it must be approved by the Owner.

B. Final Record Drawings shall also be provided in hardcopy format, three copies, printed at the full size of the original Contract Drawings.

C. Record Drawings shall be in accordance with Section 01785, Record Documents.

3.04 REQUIREMENTS FOR SUBMITTAL

A. Additional documents, drawings, interface data, and other pertinent project submittal data are listed in specific sections of this Contract.

3.05 RECORD PRINTS

A. The Contractor shall submit one set of all record prints before final completion. The record print or project records shall include submittals, catalog cuts, drawings, calculations, test reports, manufacturer's data, maintenance manuals, installation instructions, and operating manuals. All "record prints" shall be delivered to the Owner in three-ring binders with dividers and shall be placed in order by Specification Section.

END OF SECTION

SECTION 01350
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work covered by this Section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations during and as the result of construction operations under this Contract. In this Section *environmental pollution* is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic and/or recreational purposes.

B. The control of environmental pollution requires considering air, water, and land and involves managing noise and solid waste as well as other pollutants.

C. The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work. The Contractor shall provide erosion-control measures such as diversion channels, sedimentation or filtration systems, berms, staked silt fence, seeding, mulching or other special surface treatments that are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion-control measures shall be in place in an area before any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02370, Erosion and Sedimentation Control.

D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida and the Project Environmental Resource Permit. The Contractor shall prepare a sedimentation and erosion-control drawing meeting the requirements of the law and furnish two copies of the approved drawing to the Engineer.

1.02 SUBMITTALS

A. Contractor shall prepare a Stormwater Pollution and Prevention Plan (SWPPP) and a sedimentation and erosion-control drawing meeting the Florida Department of Environmental Protection (FDEP), Suwannee River Water Management District (SRWMD), and local water management district requirements. The drawing shall clearly indicate the construction entrance, delivery and storage area, in-stream turbidity controls, and proposed locations for soil stockpiles. The Contractor shall furnish two copies to the Engineer and two copies to the Owner.

B. The Contractor shall provide the Engineer with two copies of documentation that the Contractor filed with FDEP a "NOTICE OF INTENT TO USE GENERIC PERMIT FOR STORMWATER DISCHARGE FROM LARGE AND SMALL CONSTRUCTION ACTIVITIES" in accordance with Rule 62-621.300(4), FAC.

C. The Contractor shall submit two copies of approved Spill Prevention Control and Countermeasures (SPCC) plans to the Owner and the Engineer.

D. If the Contractor proposes to construct temporary roads or embankments and excavations for work areas, the Contractor shall submit the following to the Owner for approval at least 10 days before the scheduled start of such temporary work:

1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the work area.
2. Details of temporary road construction.
3. Drawings and cross-sections of proposed embankments and their foundations, including a description of proposed materials.
4. Drawings showing the proposed restoration of the area. The proposed removal of any trees and shrubs must be indicated. The Contractor is responsible for obtaining necessary tree clearing permits with the local municipalities.
5. Locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged.
6. The drawings shall provide for the obliteration of construction scars as such and shall provide for a natural appearing and functioning final condition of the area.
7. Modification of the Contractor's approved drawings shall be made only with the written approval of the Owner. No unauthorized road construction, excavation, or embankment construction including disposal areas will be permitted.
8. The Contractor shall mark/flag the proposed temporary work in the filed for review by the Owner before beginning such work.

1.03 WORK SEQUENCE

A. Before beginning the Work, the Contractor shall meet with the Owner to establish agreed-upon compliance with these provisions and administration of the environmental pollution control program.

B. The Contractor shall remove temporary environmental control features when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

1.04 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

B. The Contractor shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

A. The Contractor shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion-control measures, such as temporary vegetation, siltation basins, mulch check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Surface water shall be prevented from flowing into excavated areas. Ditches may be used around the construction area to carry away water resulting from dewatering excavated areas. At the completion of the Work, erosion and sedimentation controls shall be removed and the ground surface restored to its original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

A. Care shall be taken to prevent or reduce to a minimum any damage to any stream or surface water from pollution by debris, sediment, or other material or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before

being directed into streams or surface waters. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

B. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the FDEP. The Contractor shall submit two copies of approved contingency plans to the Engineer.

C Water being flushed from structures or pipelines after disinfection with Chlorine (Cl_2) shall be treated with a dechlorination solution approved by the Engineer before discharge.

3.03 PROTECTION OF LAND RESOURCES

A. After completion of construction, the Contractor shall restore land resources within the project boundaries and outside the limits of permanent work to a condition that will appear to be natural and not detract from the appearance of the project. All construction activities shall be confined to areas shown on the Drawings.

B. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, the Contractor shall first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.

C. The Contractor shall protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping, or other operations by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.

D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original

condition. The Owner will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.

1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and, in the opinion of the Owner, are beyond saving shall be immediately removed and replaced.

E. The Contractor's storage and other construction buildings required temporarily in the performance of the work shall be located in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Owner and shall not be within wetlands or floodplains. Preserving the landscape shall be required in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for the Owner's approval.

F. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess waste materials, or any other vestiges of construction as directed by the Engineer. Excavating, filling, and plowing of roadways are expected to be required to restore the area to near natural conditions which will permit the growth of vegetation the roadway areas. The disturbed areas shall be prepared and seeded as approved by the Owner.

G. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

A. Burning—Burning will not be permitted at the project site for the disposal of refuse and debris.

B. Dust Control—The Contractor shall maintain all excavations, embankment, stockpiles, access roads, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.

C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides is prohibited.

D. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Owner.

3.05 NOISE CONTROL

A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.06 MAINTENANCE OF POLLUTION-CONTROL FACILITIES DURING CONSTRUCTION

A. During the life of this Contract, the Contractor shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.07 PERMIT COMPLIANCE REQUIREMENTS

A. The Contractor shall comply with all conditions of permits and crossing agreements obtained by the Owner or required to be obtained by the Contractor, including but not limited to:

1. Columbia County.
2. Florida Department of Environmental Protection.
3. US Army Corps of Engineers.
4. Florida Department of Transportation.
5. Florida Gas Transmission.
6. Florida Power and Light.

END OF SECTION

SECTION 01355
SPECIAL PROVISIONS

PART 1 GENERAL

1.01 SPARE PARTS

A. Where spare parts are specified in the Specification Sections, the Contractor shall furnish all spare parts recommended by the manufacturer or system supplier for 1 year of service. In addition, the Contractor shall furnish all spare parts itemized in each Section.

B. The Contractor shall collect and store all spare parts in an area to be designated by the Owner and shall furnish the Owner with 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 delivery cost.

C. Spare parts shall be packed in cartons properly labeled with indelible markings with complete descriptive information, including manufacturer, part number, part name, and equipment for which the part is to be used and shall be properly treated for 1 year of storage.

1.02 HURRICANE PREPAREDNESS PLAN

A. Within 30 calendar days of the date of Notice to Proceed, the Contractor shall submit a Hurricane Preparedness Plan to the Owner for approval. The Plan shall describe in detail the necessary measures that the Contractor will perform, at no additional costs to the Owner, in case of a hurricane warning. The Contractor shall revise the Plan as required by the Owner.

1.03 WEATHER PROTECTION

A. In the event of inclement weather, the Contractor shall protect the Work and materials from damage or injury from the weather. If, in the opinion of the Owner, any portion of the Work or materials has been damaged by reason of failure on the part of the Contractor to protect the Work, such Work and materials shall be removed and replaced with new materials and Work to the satisfaction of the Owner.

1.04 PROVISIONS FOR CONTROL OF EROSION

A. The Contractor shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the wetlands and surface waters of the State. Control measures must be adequate to ensure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations that promote erosion.

1.05 PROVISIONS FOR THE CONTROL OF DUST AND LITTER

A. The Contractor shall take sufficient precautions during construction to minimize the amount of dust created. Wetting down the Site may be required or as directed by the Owner to prevent dust as a result of vehicular traffic, site clearing, and/or various construction activities. Control of litter and/or blowing debris caused by any regrading by the Contractor shall be the responsibility of the Contractor.

1.06 ON-SITE STORAGE

A. The Contractor should note that there may be special storage requirements and possible charges for noncompliance of on-site storage requirements for materials and equipment as specified in Section 01600, Materials and Equipment.

1.07 ELECTRICAL POWER AND TESTING EQUIPMENT

A. The Contractor shall furnish electric power and all equipment and tools required for testing equipment. The cost of this electric power, equipment, and tools shall be included in the prices quoted in the Bid Form.

1.08 DAMAGE DUE TO HIGH WATER

A. The Contractor will be responsible for all damage done to his work by heavy rains or floods and he shall take all reasonable precautions to provide against damages by building such temporary dikes, channels, or shoring to carry off stormwater as the nature of the work may require.

1.09 EMERGENCY PHONE NUMBERS AND ACCIDENT REPORTS

A. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor's phone and the phone's location be made known to all.

B. Accidents shall be reported immediately to the Owner by message or phone.

C. The Contractor shall document all accidents and shall submit to the Owner a fully detailed written report about the accident within 1 week following each accident.

1.10 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. The Contractor shall provide such items in accordance with the Specification on the Drawings.

1.11 SALVAGE

A. Any existing equipment or material, including but not limited to valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Owner and, if so, shall be excavated, if necessary, and shall be cleaned and stored on or adjacent to the Site in a protected place specified by the Owner or loaded onto trucks provided by the Owner. Any equipment or material not worthy of salvaging, as directed by the Owner, shall be disposed of by the Contractor at a suitable location at the Contractor's expense.

1.12 WORKMANSHIP, MATERIAL, AND EQUIPMENT

A. When a particular product or products are specified or called for, it is intended and shall be understood that the proposal tendered by the Contractor include those products in his bid. Should the Contractor desire to substitute a product or products equal to those specified, the Contractor shall furnish information as described in the Standard General Conditions. The alternate product or products submitted by the Contractor shall meet the requirements of the Specifications and shall, in all respects, be equal to the product or products specified by name in the Specifications.

B. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Work shall be the new and unused standard products of recognized reputable manufacturers.

1.13 RESPONSIBILITY OF CONTRACTOR

A. The Contractor shall be responsible for the entire Work determined by the Drawings, Specifications, and Contract from the date of the starting of the Work until it is accepted as evidence of approval of the Completion Certificate by the Owner. The Contractor shall be responsible for removals, renewals, and replacements due to action of the elements and all other causes except as otherwise provided in the Specifications. The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the work personally or shall have a competent English-speaking superintendent or representative, who shall be on the site of the project at all working hours and who shall be empowered with full authority by the Contractor to direct the performance of the Work and make arrangement for all necessary materials, equipment, and labor without delay.

B. Renewals or repairs required because of defective materials or workmanship or due to the action of the elements or other natural causes, including fire and flood, before the acceptance as determined by the Completion Certificate, shall be done in accordance with the Contract and Specifications at the expense of the Contractor.

1.14 CONSTRUCTION CONDITIONS AND SUBSURFACE INVESTIGATION

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

B. The Contractor shall be responsible for having determined to his satisfaction, before submitting his bid, the nature and location of the Work, the conformation of the ground, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed before and during the execution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. The prices established for the work to be done will reflect all costs pertaining to the Work. Any claims for extras based on substrata, groundwater table, and other such conditions will not be allowed.

1.15 SUSPENSION OF WORK DUE TO WEATHER

A. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the Owner as to suspensions shall be final and binding. The ability to issue such an

order shall not be interpreted as a requirement to do so. During suspension of the work from any cause, the Work shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise, and if the Owner shall so direct, the rubbish and surplus materials shall be removed.

1.16 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits, including building permits, NPDES permits, dewatering permits, and any other required permits not previously obtained by the Owner to do the Work from the appropriate governmental agency or agencies. No work shall begin until all applicable permits have been obtained and copies delivered to the Owner. The Contractor shall bear all costs for obtaining all permits.

1.17 PUMPING

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

B. For the duration of the Contract and with his own equipment, the Contractor shall pump out water and wastewater which may seep or leak into the excavations or structures.

1.18 CLAIMS FOR PROPERTY DAMAGE

A. Upon notification by the Owner, the Contractor shall investigate each claim for property damage and shall file, within 10 days of such notification, a statement with the Owner setting forth all facts and details relative to the claim.

1.19 DAILY REPORTS

A. The Contractor shall submit daily reports of construction activities, including non-workdays. The report shall include the following:

1. Manpower, number of workers by craft.
2. Equipment on the project.
3. Major deliveries.
4. Activities work with reference to the CPM schedule activity numbers.
5. New problems.
6. Weather conditions including amount of daily rainfall.
7. Other pertinent information.

B. A similar report shall be submitted for/by each subcontractor.

C. The reports shall be submitted to the Owner within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager.

1.20 CONNECTIONS TO EXISTING SYSTEMS

A. The Contractor shall perform all work necessary to locate, excavate, and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Owner. The cost of this work and for the actual connection of the existing mains shall be included in the bid for the Project and shall not result in any additional cost to the Owner.

1.21 COORDINATION OF WORK

A. The Contractor shall afford other contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with such other work. The Contractor shall coordinate his Work with the Owner and other contractors to store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the Work so that it will not unduly interfere with the progress of the Work or the work of any other contractors.

B. If the execution or result of any part of the Work depends on any work of the Owner or of any separate contractor, the Contractor shall, before proceeding with the Work, inspect and promptly report to the Owner in writing any apparent discrepancies or defects in such work of the Owner or of any separate contractor that render it unsuitable for the proper execution or result of any part of the Work.

C. Failure of the Contractor to inspect and report any deficiencies shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects which may develop in the Owner's or separate contractor's work after completion of the Work and which the Contractor could not have discovered by his inspection before the Work was completed.

D. If the Contractor damages the work or property of the Owner or of any separate contractor on the Project or other work on the Site, or delays or interferes with the Owner's work on ongoing operations or facilities or adjacent facilities or the separate contractor's work, the Contractor shall be liable for damage caused, and, in the case of another contractor, the Contractor shall attempt to settle the claim with the other contractor before the other contractor institutes litigation or other proceedings against the Contractor.

E. If a separate contractor sues the Owner on account of any damage, delay, or interference caused or alleged to have been caused by the Contractor, the Owner

shall notify the Contractor, who shall defend the Owner in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner, the Contractor shall satisfy the same and shall reimburse the Owner for all damages, expenses, attorneys' fees, and other costs which the Owner incurs as a result of the judgment or award.

F. If a separate contractor causes damage to the Work or to the property of the Contractor or causes delay or interference with the Contractor's performance of the Work, the Contractor shall present directly to the separate contractor any claims it may have as a result of such damage, delay, or interference (with an information copy to the Owner) and shall attempt to settle its claim against the separate contractor before instituting litigation or other proceedings against the separate contractor.

G. In no event shall the Contractor seek to recover from the Owner or the Engineer, and the Contractor hereby represents to the Owner and the Engineer that he will not seek to recover from them, or either of them, any costs, expenses, (including, but not limited to, attorneys' fees) or losses of profit incurred by the Contractor as a result of any damage to the Work or property of the Contractor or any delay or interference caused or allegedly caused by any separate contractor.

H. The Owner shall determine and adjust any difference or conflict which may arise between the Contractor and other contractors who may be performing work on behalf of the Owner or between the Contractor and workmen of the Owner in regard to their work. If the work of the Contractor is delayed because of any acts of omissions of any other contractor of the Owner, the Contractor shall on that account have no claim against the Owner other than for an extension of time.

1.22 FINAL GUARANTEE

A. The Contractor shall guarantee all work for 1 year from the date of Substantial Completion of the Work by the Owner.

B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Owner, are rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall do the following promptly upon receipt of notice from the Owner and without expense to the Owner:

1. Place in satisfactory condition in every way all such guaranteed work and correct all defects in the guaranteed work.
2. Make good all damage to the building or site, or equipment or piping, or their contents, which, in the opinion of the Owner, is the result of the use

of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract.

3. Make good any work or material or the equipment and contents of the building, structure, or site disturbed in fulfilling any such guarantee.

C. If the Contractor, after notice, fails to proceed to comply with the terms of this guarantee within 10 days, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expenses incurred provided. However, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor and the Contractor shall pay the cost of such repairs.

D. All special guarantees or warranties applicable to specific parts of the Work as may be stipulated in the Contract Specifications or other papers forming a part of this Contract shall be subject to the terms of this Paragraph during the first year of life of each such guarantee. The Contractor shall assemble all special guarantees and manufacturers' warranties, along with a summary list of the special guarantees and warranties, and deliver these to the Owner before the Work is accepted.

1.23 RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

A. With the approval of the Owner, the Contractor may use on the project such stone, gravel, sand, or other material determined suitable by the Owner as may be found in the excavation. The Contractor shall replace at his own expense, with other acceptable material, all of that portion of the excavation materials so removed and used which were needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials used will be made against the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01400
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. General

1. This Section defines minimum requirements for the Quality Assurance (QA) Program to be provided by the Contractor. The deliverable documents are defined, along with the method of execution of the QA Program.
2. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.
3. Specified tests, inspections, and related actions do not limit the Contractor's Quality Control (QC) procedures that facilitate compliance with the Contract Documents.

B. Definitions

1. Quality Assurance services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with Contract requirements.
2. Quality Control services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements.

C. Payment

1. Separate payment will not be made for providing and maintaining an effective Quality Assurance and Quality Control Program, and all costs associated with such a program shall be included in the applicable unit prices, lump-sum prices, or allowances contained in the Contract Price Breakdown.

1.02 WORK SEQUENCE

A. Where reference is made to a particular standard, the revision in effect at the time of Bid opening shall apply except where a specific date is established.

B. For products or workmanship specified by association, trades, or other consensus standards, the Contractor shall comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code.

C. If specified reference standards conflict with Contract Documents, the Contractor shall request clarification from the Engineer before proceeding.

1.03 QUALITY ASSURANCE

A. The Contractor shall install all materials and equipment in a neat and first-class workman-like manner.

B. The Contractor shall replace all existing paving, stabilized earth, curbs, driveways, sidewalks, fences, signs, and other improvements with the same type of material that was removed during construction or as directed by the Engineer without increase in the Contract Price or Contract Time.

C. The Engineer reserves the right to direct the removal and replacement of any items that, in the Engineer's opinion, do not present an orderly and reasonably neat or workman-like appearance, provided such an orderly installation can be made using customary trade methods. The removal and replacement shall be done when directed in writing by the Engineer at the Contractor's own expense and without additional expense to the Owner.

1.04 TOLERANCES

A. Monitor tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. If manufacturers' tolerances conflict with Contract Documents, request clarification from the Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.05 FIELD SAMPLES

A. The Contractor shall furnish field samples at the site, as required by individual Specifications Sections for review.

B. Acceptable samples represent a quality level for the Work.

C. Where field sample is specified in individual sections to be removed, the Contractor shall clear the area after the field sample had been accepted by the Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor is responsible for quality control and shall establish and maintain an effective QC system in compliance with the Contract Documents. The QC system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract requirements. The system shall cover all Work and shall be keyed to the proposed design and construction sequence. The project QC Officer will be held responsible for the quality of work on the job and is subject to removal by the Engineer for non-compliance with quality requirements specified in the Contract. The project QC Officer in this context shall mean the individual with the responsibility for the overall management of the project quality.

3.02 QUALITY CONTROL PLAN

A. General: Not later than 30 calendar days after receipt of Notice to Proceed, the Contractor shall furnish for review by the Engineer the QC Plan proposed to implement the requirements of the Contract. The Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Engineer will consider an interim plan for the first 30 calendar days of operation.

B. Content of the QC Plan: The QC Plan shall include, at a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers, and purchasing agents:

1. A description of the quality control organization, including a chart showing lines of authority for all aspects of the Work specified. The staff shall include a Quality Control Officer who shall report to the Project Manager or executive.
2. The name, qualifications (in résumé format), duties, responsibilities, and authorities of each person assigned a QC function.
3. A copy of the letter to the Quality Control Officer signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Officer, including authority to stop work which is not in compliance with the Contract.

4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents.
5. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will verify that identified deficiencies have been corrected.
6. Reporting procedures, including proposed reporting formats.

C. Acceptance of Plan: Acceptance of the Contractor's plan is required before the start of Work. Acceptance is conditional and will be predicated on satisfactory performance during the Work. The Engineer reserves the right to require the Contractor to make changes in its QC Plan and operations, including removing personnel as necessary to obtain the quality specified.

D. Notification of Changes: After acceptance of the QC Plan, the Contractor shall notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

3.03 SUBMITTALS

A. Submittals shall be made as specified in Section 01330, Submittals and Acceptance. The QC organization shall be responsible for certifying that all submittals comply with the Contract requirements.

3.04 TESTS

A. Testing Services

1. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to the Owner. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
2. Testing services provided by the Owner are for the sole benefit of the Owner; however, test results shall be available to the Contractor. Testing necessary to satisfy the Contractor's internal Quality Control Procedures shall be the sole responsibility of the Contractor.
3. When necessary, the Contractor shall interrupt its Work for Owner sampling and testing. The Contractor shall have no Claim for increase in Contract Price or Contract Time due to such interruption. The Contractor shall cooperate in these testing activities, as needed.
4. Testing, including sampling, will be performed by the testing firm's laboratory personnel in the general manner indicated in the Specifications.

B. Transmittal of Test Reports: Written reports of tests and engineering data furnished by the Contractor for the Engineer's review shall be submitted as specified for Shop Drawings.

C. Manufacturer's Field Services

1. The manufacturer's field services will be specified in the respective equipment sections.
2. An experienced, competent, and authorized representative of the manufacturer of each item of equipment for which field services are indicated 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 into operation. The manufacturer's representative shall revisit the site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.
3. Each manufacturer's representative shall furnish to the Owner, through the Engineer, a written report certifying 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, has been operated under full load conditions, and has operated satisfactorily.

3.05 COMPLETION INSPECTION

A. Final Completion Punch List: Near the completion of all Work, the QC Officer shall inspect the Work and develop a "punch list" of items that do not conform to the approved Drawings and Specifications. Such a list of deficiencies shall be included in the QC documentation and shall include the estimated date by which the deficiencies shall be corrected. The QC Officer or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Engineer that the Facility is ready for the Engineer's final inspection.

B. Final Inspection and Acceptance: The Contractor's QC Officer and the Engineer will be in attendance at this inspection. Additional Engineer personnel may also be in attendance. The final acceptance inspection will be formally scheduled by the Engineer when all punch list deficiencies have been corrected. Notice will be given to the Engineer at least 14 days before the final inspection and must include the Contractor's assurance that all punch list items will be complete and acceptable by the date scheduled for the final inspection. Failure of the Contractor to have all Contract Work acceptably complete for this inspection will be cause for noncertification of final payment by the Engineer.

3.06 NOTIFICATION OF NONCOMPLIANCE

A. The Engineer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

3.07 REPAIR AND PROTECTION

A. On completion of testing, inspection, sampling, and similar services, the Contractor shall repair damaged construction and restore substrates and finishes.

B. The Contractor shall protect all construction exposed by or for Quality Control service activities.

C. The repair and protection are the Contractor's responsibilities, regardless of the assignment of responsibility for Quality Control services.

END OF SECTION

SECTION 01450
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor will pay for the costs of all laboratory tests required to determine soil density, concrete compressive strength, asphalt compressive strength and other testing to determine compliance with the Contract Documents. All required testing shall be coordinated and scheduled by the Contractor.

1. The Contractor shall cooperate with the laboratory to facilitate the execution of required services.
2. The Owner shall approve the selection of the testing laboratory.
3. Employment of a testing laboratory shall in no way relieve the Contractor of the obligation to perform work in accordance with the requirements of the Contract Documents.
4. The Owner shall provide the water required for hydro-testing the 250,000-gallon equalization tank, the largest tank on site. That water shall then be re-used to test the other structures on site.

1.02 RELATED WORK

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities.

B. Respective Sections:

1. Certification of products.
2. Laboratory tests required and standards for testing.

1.03 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit to the Engineer for review a list and schedule of all tests to be conducted.

C. Describe test procedures along with the duration of tests.

D. After each inspection and test, the Laboratory shall promptly submit two copies of the laboratory report to the Engineer, one copy to the Contractor, and one copy to the Owner.

E. Include the following:

1. Date issued.
2. Project title and number.
3. Name of field testing technician or inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specifications Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of test.
10. Conformance with Contract Documents.

F. When requested by the Engineer, provide interpretation of test results.

1.04 REFERENCE STANDARDS

A. Reference standards and recommended practices shall be the latest revision of any such document in effect at the bid time.

1.05 QUALITY ASSURANCE

A. The Laboratory is not authorized to do any of the following:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Engineer of Record or the Engineer.

B. The Contractor shall be responsible for the following:

1. Cooperating with laboratory personnel, providing access to work and to manufacturer’s operations.

2. Securing and delivering to the laboratory adequate quantities of representative samples of materials proposed to be used and that require testing.

3. Providing to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes that require control by the testing laboratory.

4. Furnishing incidental labor and facilities:

   a. To provide access to Work to be tested.
   b. To obtain and handle samples at the project site or at the source of the product to be tested.
   c. To facilitate inspections and tests.
   d. To store and cure test samples.

5. Notifying the Engineer and laboratory sufficiently in advance of operations to allow the laboratory time to assign personnel and schedule tests.

6. Employing and paying for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Equipment Supplier or Contractor's (as applicable) convenience.

C. Materials and equipment used in the performance of Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the equipment supplier or Contractor (as applicable) to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

D. If the test and any subsequent retest results indicate that the materials or equipment fail to meet the requirements of the Contract Documents, the equipment supplier or Contractor (as applicable) shall pay for the laboratory costs.

1.06 QUALIFICATIONS

A. Laboratory: Licensed to operate in Florida.

B. Laboratory Staff: Maintain a full-time Florida-registered Professional Engineer on staff to review the services performed under this project.

C. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

D. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performing services.

E. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

F. Ascertain compliance of materials and mixes with requirements of Contract Documents.

G. Promptly notify the Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

H. Perform additional inspections and tests required by Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RESPONSIBILITY

A. This Section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the Project. The Contractor is solely responsible for the requirements set forth in this Section.

1.02 ONSITE TEMPORARY

A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. Before availability of temporary utility services, the Contractor will provide trucked-in/trucked-out containerized or unitized services for start-up of construction operations at the site.

1.03 COSTS

A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

1.04 TEMPORARY FACILITIES

A. The types of utility services required for temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):

1. Electrical Power Service.
2. Water Service (potable for certain uses).
3. Sanitary.
4. Storm Sewer or Open Drainage/Run-off Control.
5. Gas/Diesel (fuel) Service.
6. Telephone Service.
7. Internet.

1.05 TEMPORARY ELECTRICITY

A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the Work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

1.06 TEMPORARY WATER

A. The Contractor shall make all necessary application and arrangements and pay all fees and charges for water necessary for the proper completion of the Project up to the time of final acceptance. The Contractor shall provide and pay for any temporary piping and connections.

1.07 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

1.08 STORM SEWER

A. The Contractor shall provide adequate stormwater containment and treatment through open drainage or direction into a stormwater collection system.

1.09 FUEL/DIESEL

A. The Contractor shall provide all his own fuel for generating power, operating vehicles, and equipment. The fuel shall be stored in a safe location and double-contained to prevent leakage.

1.10 CLEANLINESS OF FACILITIES

A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.11 TERMINATION AND REMOVAL

A. At the time the need for a temporary utility service has ended or has been replaced by use of permanent services, or no later than the time of final completion, the Contractor shall promptly remove the installation unless requested by the Engineer to retain it for a longer period. Any work that may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces, shall be completed at this time. The Contractor shall replace any work damaged beyond acceptable restoration.

1.12 NOISE CONTROL

A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

1.13 DUST CONTROL

A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, or any other cause.

1.14 WATER CONTROL

A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for review before initiating and implementing the plan. Approval shall be obtained from the proper authorities before the use of public or private lands or facilities for such disposal.

1.15 POLLUTION CONTROL

A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

1.16 ADVERSE IMPACT

A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment that may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters, vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

1.17 STREAMS, LAKES, AND OTHER BODIES OF WATER

A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with the movements of migratory fish.

1.18 CHEMICALS

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

1.19 EROSION CONTROL

A. The Contractor shall not expose by construction operations a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion-control features shall be constructed concurrently with other work and at the earliest practicable time.

1.20 STORAGE FACILITIES

A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products that are subject to deterioration shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter. Any products that will come in contact with water shall be stored off the ground to prevent contamination.

1.21 INSPECTION

A. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to ensure that they are maintained under specified conditions and free from damage or deterioration.

1.22 TEMPORARY PROTECTION

A. After installation, the Contractor shall provide substantial coverings as necessary to installed products to protect them from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

1.23 ADJACENT TO WORK

A. The Contractor shall protect from damage all property along the line of the Work or in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

1.24 REMEDY BY OWNER

A. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the Owner may, after 48 hours' notice to the Contractor, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost of such repairs, rebuilding, or restoration will be deducted from any monies due or which may become due to the Contractor under this Contract.

1.25 PROTECTION FROM DAMAGE

A. The Contractor shall be responsible for protecting property in the areas in the vicinity of the Project and for protecting his equipment, supplies, materials, and work against any damage resulting from the elements, such as flooding, rainstorm, wind damage, or other such damage, and shall be responsible for damage resulting from the same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection throughout the contract period for the protection of his, the Owner's, and other properties from such damage.

1.26 TRAFFIC REGULATION

A. Signs, marking barricades, and procedures shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.

1.27 SIGNAGE

A. The Contractor shall provide and maintain adequate barricades around open excavations.

1.28 REMOVAL OF SIGNAGE

A. On completion of the Work, the Contractor shall remove all debris, excess materials, barricades, and temporary work, leaving walkways and roads clear of obstructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01520
FIELD OFFICES

PART 1 GENERAL

A. Within 2 weeks after starting work, the Contractor shall provide a minimum of one field office trailer including space for use of the Owner and Owner's representatives. The Contractor shall maintain the field office until the completion of the work to be done under this Contract.

1. The field office shall be a minimum 8 feet by 28 feet. The Owner's space within the field office shall be a minimum of 8 feet by 8 feet, unless otherwise approved by Owner.
2. Installation of the field office shall meet all local codes and ordinances. At a minimum, the Contractor shall install the structure on a level, well-drained area and secure it against wind in accordance with applicable requirements of the Florida Building Code and ASCE-7.
3. The field office shall be provided with structurally sound and safe steps and landings for each door. The doors shall have secure locks.
4. The field office shall be designated as a "No Smoking Area."
5. The windows shall be arranged for cross ventilation with screens.
6. The Contractor shall provide air conditioning and heating systems with thermostat control.
7. The Contractor shall provide electric power for the duration of the Project.
8. On completion of the Project, the Contractor shall remove the field office and all such temporary facilities from the site at a time discussed and agreed to with the Owner. The Contractor shall remove foundations and debris, remove any temporary pavement, compacted ground or base materials (such as limerock or stabilized soils created by the Contractor for construction parking or storage), grade the site to required elevations, sod all disturbed areas, and clean and remove all trash and debris. Ensure the soil permeability for stormwater drainage is equivalent to preconstruction conditions or as required by the Contract Documents.

B. In general, at a minimum the Contractor shall provide the following:

1. Electric lights (50-foot candles at desktop height) and power supply outlets (minimum of four).
2. High-speed Internet access with dedicated Wi-Fi router for wireless access and a Wi-Fi password made available to the Owner.
3. A private telephone line with a facsimile/answering machine. Telephone outlets are to be provided at each workstation/desk area.

4. Complete toilet facilities within the field office acceptable to the Owner that meet all local and State health codes and regulations including appropriate restroom signage.
5. Fire extinguisher (Halon type, minimum 4-pound capacity).
6. Water coolers, bottled water, and paper cups for the duration of the Project.
7. Table for viewing the Project Drawings.
8. Office furnishings, as described in Article 1.05 below.
9. File cabinets, storage, bookcases, as described in Article 1.05 below.
10. Standard office supplies.
11. Miscellaneous field supplies, as described in Article 1.05 below.
12. Weekly janitorial services.

1.02 REFERENCE STANDARDS

A. Comply with all Federal, State and local codes including the National Electric Code, OSHA, FLOSHA, Florida Building Code, and ASCE-7.

B. Comply with all General Industrial standards and regulations, including but not limited to AWWA, ANSI, NEMA, IEEE, ASHRAE, UL, etc.

1.03 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.05 SPECIFIC REQUIREMENTS

A. Unless otherwise noted, the quantity shall be sufficient for the duration of the Project.

B. Office Furnishings/Equipment: The following furnishings and equipment shall be delivered and placed subject to Owner approval:

1. Owner’s Space: One office desk and chair with two guest chairs. Chairs shall be adjustable height and on rollers with arm rests.
2. Chairs in common space: Eight desk-type chairs, adjustable heights, on rollers, with armrests.

3. Drawing Table: One plywood or standard drawing tables, 3 feet by 6 feet, with all required appurtenances.
4. Printer/Copier: One color copier capable of copying, scanning, and printing pages up to and including 11-inch-x-17-inch paper size. All warranties, maintenance, and servicing for the duration of the Work. Sufficient appropriate ink/toner cartridges and paper for the Owner or the Owner's Representatives to print thirty 11-inch-x-17-inch or sixty 8-1/2-inch-x-11-inch color prints per week for the duration of the Work in addition to the Contractor's printing needs.
5. One each: 4.0-cubic-foot or larger refrigerator, microwave, coffee machine, and toaster oven.
6. Other furnishings, storage, or equipment deemed necessary by the Contractor.

C. Miscellaneous Field Supplies

1. One minimum/maximum digital thermometer with batteries for the duration of the Work.
2. Broom, dustpan, and brush.
3. One rain gauge.
4. One 36-inch-x-72-inch table and eight folding chairs.
5. Large wastebasket.
6. Wall clock.
7. Lateral Files: One HON 600 Series or equal, 42 inches wide, four-drawer.
8. Vertical Files: Two four-drawer.
9. Storage: One industrial-grade steel cabinet, locking handles, 36 inches wide by 18 inches deep by 72 inches high.
10. Bookcases: One HON metal bookcase or equal, 34-1/2 inches wide by 12-5/8 inches deep by 71 inches high, color to be selected by the Engineer.

1.06 ELECTRICITY, LIGHTING

A. The Contractor shall obtain and pay for utilities including electrical facilities and water and sanitary facilities. Connections to existing facilities will not be allowed unless properly metered and protected.

1.07 SANITARY FACILITIES

A. The Contractor shall provide suitable and adequate toilet facilities for all employees, subject to the approval of the Owner as to the type, size, and location.

B. The facilities shall be maintained in a sanitary condition, frequently cleaned and disinfected, and promptly removed from the site when directed by the Owner.

1.08 FIRST AID

A. The Contractor shall provide a completely equipped first-aid kit that shall be maintained in a clean and orderly condition in the field office.

B. Telephone numbers for summoning aid from the Police Department, Fire Department, physicians, ambulances, inhalator, and rescue squads from outside sources shall be conspicuously posted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section includes the minimum requirements for the furnished materials and equipment for this project. The more stringent requirements in the Technical Specification sections shall take precedence over these requirements for any conflicts.

A. Materials and equipment furnished by the Contractor shall be new and shall not have been in service at any other installation unless otherwise approved. They shall conform to applicable specifications approved in writing by the Owner.

B. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges so as to be interchangeable.

C. Unless restricted to a specific type by the Contract Documents or the Owner, the Contractor may perform the work using equipment, tools, machinery, etc., of his own choosing.

D. The Contractor shall provide a unique alphanumeric identification number on all equipment (other than small tools) used on the project. This number shall be a minimum of 2 inches high and appear on both sides of the equipment. Place the number in such a manner so as to contrast sharply in color with the background on which it is placed. Ensure that the number, which may be painted or otherwise permanently affixed to the equipment, is clearly legible at all times.

E. If the Contractor's equipment or procedures during construction damage any part of the facility, the Contractor shall replace or repair it as directed by the Owner at no expense to the Owner.

F. Use only factory-recommended exhaust mufflers on internal combustion engines. Remove from the job, alter, or repair equipment disapproved by the Owner. Ensure that the number of units, sizes, etc., of the equipment on hand are adequate to complete the work within the Contract Time.

G. Provide adequate equipment maintenance procedures to promote continuous satisfactory working condition and minimize noise pollution caused by construction equipment. Screen all stationary equipment such as pumps,

compressors, generators, etc., from noise sensitive receivers if that equipment is to operate beyond normal working hours. If feasible, screen this equipment during normal working hours to reduce noise impacts.

H. Quantities of items that are identical shall be by the same manufacturer, regardless of the Design Package breakdown.

I. Equipment sizes, capacities, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

J. Materials and equipment shall not be used for any purpose other than that for which they are designed or specified.

K. Where materials or equipment are specifically shown or specified to be reused in the Work, special care shall be used in removing, handling, storing, and reinstalling to ensure their proper function in the completed Work.

L. Material and equipment incorporated into the Work:

1. Shall conform to applicable specifications and standards.

2. Shall comply with size, make, type, and quality specified or as specifically approved in writing by the Owner.

3. Manufactured and fabricated products:

a. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

1.02 ACCEPTANCE OF MATERIAL AND EQUIPMENT

A. 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 site that does not meet the Contract Specifications.

B. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporating in the work. Any delay of acceptance resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner.

C. The materials and equipment used in the Work shall correspond to the approved samples or other data.

D. If requested, the Contractor shall be required to submit to the Owner ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Owner will not allow any experimental or untried type of material or machinery to be installed.

E. The equipment specified shall be carefully designed and installed to ensure that it adequately performs all required functions within the specified degree of precision. Each unit shall operate with each of the other parts of the equipment to provide a completely integrated system that shall operate to the satisfaction of the Owner.

F. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Owner, all field and operating tests shall be made in the presence of the Owner or the Owner's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Owner.

G. The Contractor shall submit copies of welding procedures for all welding. Welders and welding operators shall be selected in accordance with the qualification requirements of the AWS Code. Welders and welding operators for stainless steel shall pass qualification tests using stainless steel filler metal and procedures developed for stainless steel. Procedures, welder, and operator qualifications shall be certified by an independent testing laboratory retained and paid by the Contractor.

H. The Contractor shall not start fabrication of the Work until the Contractor receives written acceptance of the proof of welding procedures from the Owner for each type of weld.

I. The Contractor shall submit copies of mill certificate for each type of rolled steel and as required in the Specifications. The Contractor shall not start fabrication of the work until the Contractor receives written acceptance of all mill certificates from the Owner.

1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. The equipment installation details shall suit the existing and furnished equipment and are subject to acceptance by the Owner.

B. Any changes or revisions made necessary by the type and dimensions of the equipment furnished shall be made at the expense of the Contractor who shall furnish detailed drawings showing such changes or revision for the acceptance of the Owner.

C. The installation of all work shall comply with the manufacturer’s printed instructions. The Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including six copies to the Owner for distribution. One complete set of instructions shall be maintained at the job site during installation and until the Project is complete.

D. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer’s instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturer’s instructions, such conflicts shall be called to the Owner’s attention for resolution and revised instructions.

E. The Contractor shall perform work according to the manufacturer's instructions and not omit any preparatory step or installation procedure unless the instructions are specifically modified or the step or procedure exempted by the Contract Documents.

1.04 INSTALLATION OF EQUIPMENT

A. General: The Contractor shall install the equipment in accordance with the manufacturer’s instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer’s recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer’s recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall take special care to ensure proper alignment of all equipment including water control gates, pumping stations, water control structures, and appurtenances. The units shall be carefully aligned on their foundations by qualified millwrights after the units’ sole plates have been shimmed to true

alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the Manufacturer's Representative has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The Contractor shall further check the alignment of the equipment after it is secured to the foundations and, after all alignments are confirmed, shall finally grout the sole plates in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will "pipe springing" be allowed.

C. The Contractor shall install equipment, slabs, walls level and plumb, parallel, and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

D. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

E. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

F. The Contractor shall provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use Alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings, or guards, or without creating safety hazards at installed equipment elevations.
2. Exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. Extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

G. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

H. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade) as possible. In such an instance, the Contractor shall obtain the

Owner's approval for this mounting location before installing that piece of equipment in the field.

I. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations

J. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before Substantial Completion.

K. The Contractor shall furnish the service of competent manufacturers' representatives for Contractor- or Owner-furnished equipment when evident malfunction or over-heating makes such services necessary or as determined by the Owner. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

L. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure an apparatus in place. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper alignment after erection shall be done at the expense of the Contractor.

M. The Contractor shall furnish the necessary materials and construct suitable concrete foundations or pads for all equipment installed by the Contractor, even though such foundations or pads may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting.

1.05 SPECIAL TOOLS

A. Manufacturers of equipment and machinery shall furnish two sets of any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, and disassembly, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order before completing the Contract. Tools shall be high-grade, smooth, forged, alloy tool steel. Grease guns shall be lever-type.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

D. Tools shall be delivered in heavy steel toolboxes complete with lock and duplicate keys.

1.06 TESTS AND TEST REPORTS

A. When used in the Contract Documents, "Factory/Fabricating Shop Performance, Evaluation, Certification, and/or Acceptance Tests and Test Reports" shall be considered to mean the corresponding manufacturer's, fabricator's, and/or other builder's official test and tests reports. Included in these test reports shall be appropriate substantiating documentation/data ascertaining the correct and complete manufacture, fabrication, and "shop performance" (to the greatest extent normally practicable) of the particular material, equipment, system, and/or facilities proposed for eventual delivery. These are subdivided into three significant tests and test report types: 1) Certification Tests and Test Reports, 2) Factory Tests and Test Reports, and 3) Shop Performance/Evaluation Tests and Test Reports. Minimal requirements are described below.

B. Certification Tests and Test Reports

1. Standard specifications, code references, etc. for minimum quality and workmanship levels are indicated in the Contract Documents and Construction Documents. Statements, certificates, and other substantiating reporting data, called "Certification Test Reports" in this Section, of tests conducted on previously manufactured materials or equipment identical to that proposed for use shall be compiled by the Contractor.
2. At a minimum all Certification Test Reports shall contain an official analysis of sufficient material composition or show evidence of meeting or exceeding the specified material standard(s) referenced, e.g., ASTM, ASME, or other designations. All reports shall also indicate from whom the material was/will be purchased.
3. The Contractor shall pay all costs of certification tests and test reports.

C. Factory Tests and Test Reports

1. Additional tests and reports performed on material or equipment by the manufacturer or fabricator to ascertain quality or workmanship are referred to here as "Factory Tests and Test Reports."
2. Before the delivery of any Factory Test Report, the Contractor shall first submit for review and approval a detailed description of the proposed testing, including reporting procedure and criteria. Such descriptions shall

also be delivered to the Owner for review as part of the first submission of the technical submittal.

3. Materials and equipment used in the performance of the Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. If Work to be accomplished away from the construction site is to be inspected on behalf of the Owner during its fabrication or manufacture, the Contractor shall give prior notice to the Owner of the place and time where such fabrication or manufacture is to be done. Such notice shall be in writing and delivered to the Owner not less than 30 days before the Work is to be done so that the necessary arrangements for the particular factory inspection tests can be made.
4. Upon completion of the factory inspection tests and immediately following manufacture or fabrication, the Contractor shall compile a complete Factory Test Report following the approved format above. All such reports shall be delivered to the Owner for review as part of the technical submittal corresponding to such tested material or equipment.

D. Shop Performance/Evaluation Tests and Tests Reports

1. Material and equipment used in the performance of the Work of this Contract are also subject to evaluation and testing after the complete full-scale assembly into major equipment and/or systems. Shop Performance/Evaluation Tests, i.e., tests of simulated startup, steady-state, variable loading, and other normal operating conditions, for such assembled equipment/systems shall be accomplished in strict accordance with the standard testing practices specified or otherwise accepted by the Owner.
2. Before the delivery of any Shop Performance/Evaluation Test Report, the Contractor shall submit for review a detailed description of the proposed performance/evaluation tests, including anticipated reporting procedures, data reduction, and criteria used. Where appropriate, such descriptions shall also be delivered to the Owner for review as part of a first or subsequent submission of the technical submittal.
3. Should such performance/evaluation tests be accomplished away from the construction site, the Contractor shall give prior notice to the Owner of the places and times where such tests will be accomplished. Such prior notice shall be in writing and delivered not less than 30 days before such events so that necessary arrangements for the particular tests can be made.
4. The requirements above pertaining to Factory Tests and Test Reports shall be incorporated for shop Performance/Evaluation Tests and Test Reports. Unless factory tests are coincident with shop performance tests and vice versa for the same material or equipment, a minimum of 15 days shall be scheduled between such multiple equipment tests where extended travel is required.

E. Cost of Performance Shop Tests

1. The Contractor shall conduct shop performance full-scale tests at its expense on all equipment as specified. Each piece of equipment shall be tested completely assembled and the shop tests performed by the equipment manufacturer until successful tests are achieved.
2. If the performance tests are conducted outside the continental United States, the Contractor shall pay all transportation expenses incurred by the Owner's representatives in witnessing the tests at no additional cost to the Owner.

1.07 FIELD TESTING

A. Field-testing shall be conducted when called for in the Technical Specification Sections and on all completed systems in general. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in Division 11, Equipment. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Owner approves their use for this project. The Contractor shall refer to Division 11, Equipment, regarding equipment shop testing requirements.

B. After completing the installation, the Contractor shall test the system in the presence of the Owner and under actual operating conditions. Tests shall be performed according to the manufacturer's recommendations.

C. The Contractor shall include with its bid the services of the equipment manufacturer's field service technician for a period necessary to complete the Work to the satisfaction of the Owner.

D. This service shall be for the purposes of checkout, initial start-up, certification, and instruction of facilities personnel.

E. A written report covering the technician's findings and installation approval shall be submitted to the Owner covering all inspections and outlining in detail any deficiencies noted.

1.08 ACCEPTANCE OF INSTALLATION

A. The Owner may accept an equipment system installation as ready for Substantial Completion when:

1. The Owner has accepted all factory tests and all other component testing.
2. The Owner has accepted all performance shop tests.
3. All components of the system are installed and tested, including without limitation hydrostatic tests, leak tests, continuity tests, insulation resistance tests, phase rotation tests, bump tests, stroke testing, calibration, adjustment for proper operation, and all other component tests as appropriate.
4. Field start-up activities have been completed and approved by the Owner.
5. The appropriate certificates have been submitted.
6. All equipment has met the performance requirements.
7. The Owner has accepted integrated system tests and adjustments performed by the Contractor to demonstrate that the system as a whole functions reliably and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component or of the system as a whole.
8. The Owner has accepted integrated facilities tests performed by the Contractor to demonstrate that the entire Construction functions together reliably as an integrated facility and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component.
9. The Owner has accepted facilities performance tests which demonstrate that the design criteria and performance criteria are met.
10. The Owner has accepted the O&M Manuals.
11. All required Owner personnel have been trained.
12. All other Contract requirements for Substantial Completion have been satisfied.

1.09 GREASE, OIL, AND FUEL

A. All grease, oil, fuel filters, seals, and gaskets required for start-up and 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 for each item of equipment supplied.

B. The Contractor shall be responsible for changing the oil in all drives, intermediate drives, and gearboxes of mechanical equipment no greater than 30 days after initial break-in of the equipment.

1.10 ELECTRICAL EQUIPMENT ENCLOSURES

A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the appropriate electrical sections of the Specifications. Enclosures for electrical equipment, such as switches and starters, shall conform to the requirements specified under the appropriate electrical sections of the Specifications.

1.11 EQUIPMENT DRIVE GUARDS

A. Screens, guards, or cages shall be provided for all exposed rotating or moving parts in accordance with accepted practices of applicable governmental agencies. Unless specified otherwise in the Technical Specifications sections, guards shall be constructed of galvanized sheet steel or galvanized woven wires or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment.

1.12 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous-impregnated felt, heavy -bituminous coatings, nonmetallic separators or washers, or other acceptable non-conducting materials.

1.13 CONCRETE INSERTS

A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

1.14 SLEEVES AND OPENINGS

A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. Each sleeve shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of the slabs and to project 2 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.

B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.

C. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

1.15 SERVICES OF MANUFACTURERS' FIELD SERVICE TECHNICIAN

A. Bid prices of equipment furnished shall include the cost of a competent field service technician of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance. The approved manufacturer's operation and maintenance data as specified in Section 01830, Operations and Maintenance Manuals, shall be delivered to the Owner before instructing the Owner's personnel. This supervision may be divided into two or more periods as required by the installation program or as directed by the Owner.

B. After the equipment has been installed and the equipment is presumably ready for operation, but before it is operated by others, the manufacturers' field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracked or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.
5. Calibration and adjustment of all related instrumentation and controls.
6. Energize equipment.
7. Deficiency correction.
8. Demonstration of compliance with application performance specification.

C. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

D. Upon completion of this operation, testing, and adjustment, the manufacturers' field service technician shall submit to the Owner, in triplicate, a complete, signed report of the results of the inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01650
DELIVERY, STORAGE, AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection of all items required in the construction of the Work. Specific requirements, if any, are specified with the related item.

1.02 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in this Section for storing and protecting the items.

B. The Contractor shall do the following:

1. Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment shall be used and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

2. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.

3. The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner. The Contractor shall be responsible for the proper transport, handling, and storing of all materials, and materials shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, so that the Work will be done in a timely manner.

4. The Contractor shall coordinate deliveries of products with construction schedules to avoid conflict with work and conditions at the site. The Contractor shall also do the following:

    a. Deliver products in undamaged condition, in the manufacturer's original containers or packaging, with identifying labels intact and legible.
    b. Immediately on delivery, inspect shipments to ensure compliance with requirements of the Contract Documents and approved submittals and to ensure that the products are properly protected and undamaged.

5. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

6. All materials and equipment shall be stored on-site in complete compliance with the manufacturer’s recommendations.

7. Store products subject to damage by the elements in weather-tight enclosures.

8. Maintain temperature and humidity within the ranges required by the manufacturer's instructions.

9. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products that are subject to deterioration with impervious sheet coverings, and provide adequate ventilation to avoid condensation.

10. 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 that will prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.

11. All materials which, in the opinion of the Owner, 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.

12. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to ensure that products are maintained under specified conditions, free from damage or deterioration.

13. The Contractor shall provide substantial coverings as necessary to protect installed products from traffic damage and subsequent construction operations and shall remove these coverings when they are no longer needed.

14. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract, within 7 days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in the previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may include expenditures for labor, equipment use, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

15. Schedule delivery to reduce long-term onsite storage before installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 1 month before installation without written authorization from the Owner.

16. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

17. Deliver products to the site in the manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.

18. Unload and place all items delivered to the site in a manner which will not hamper normal construction operation nor that of subcontractors and other contractors and will not interfere with the flow of necessary traffic.

19. Provide necessary equipment and personnel to unload all items delivered to the site.

20. The Contractor shall store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Follow storage instructions, review them with the Owner, and keep a written record of this. Arrange storage to permit access for inspection.

21. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

22. Store cement and lime under a roof and off the ground and keep it completely dry at all times. All structural, miscellaneous, 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 shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Handle and store brick, block, and similar masonry products in a manner to keep breaking, cracking, and spilling to a minimum.

23. Store all mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) in a weathertight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Owner. The building shall be provided with adequate ventilation to prevent condensation. The Contractor shall ensure that temperature and humidity are maintained within the range required by the manufacturer.

    a. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
    b. 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, at least at half load, once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.
    c. Lubricants shall be changed when installation is complete and as frequently as required thereafter during the period between installation and acceptance. The Contractor shall put new lubricants into the equipment at the time of acceptance.
    d. Before accepting equipment that has been stored for some time, 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01720
FIELD ENGINEERING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Provide and pay for the following field engineering services required for the Project:

1. Survey work required in the execution of the Project.
2. Civil, structural, or other professional engineering services specified or required to execute the Contractor’s construction methods.

B. Retain the services of a registered land surveyor licensed in Florida to do the following:

1. Identify existing control points and property line corner stakes as required.
2. Verify all existing structure locations and all proposed structure corner locations, tank locations, and equipment locations within the Project site.
3. Maintain an accurate location of all buried piping 4 inches in diameter and larger.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit to the Engineer the name and address of the registered land surveyor or professional engineer.

C. On request of the Engineer, the Contractor shall submit documentation to verify the accuracy of field engineering work.

D. The Contractor shall submit a certificate signed by a registered land surveyor certifying that elevations and locations of improvements are in conformance or non-conformance with Subcontract Documents.

E. At the end of the Project and before final payment, submit the certified drawings listed below with the Surveyor's title block (signed and sealed by the registered

land surveyor) of the items listed below. These drawings shall be included with and made a part of the project record documents.

1. Certified site survey at 1-inch = 10-foot scale on sheets 24 inches by 36 inches, indicating the building corners, sidewalks, paved areas, and location of all above-ground structures for the project site.
2. Certified drawing showing the location, lines, and grades of all lines 4 inches in diameter and larger buried and exterior to buildings and other buried facilities (e.g., valves, tanks, vaults) installed as a result of the work. This shall be at the same scale as the Engineer's yard piping drawing.
3. Certified drawings showing elevations of all flow control points such as weirs, elevations of all existing and new structures, and equipment in the treatment plant.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. All work shall be performed in accordance with the Minimum Technical Standards set forth by the Board of Professional Surveyors and Mappers.

1.04 QUALITY ASSURANCE

A. Existing basic horizontal and vertical control points for the project are those designated on Drawings.

B. Locate and protect control points before 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 the surveyor to correctly replace project control points that may be lost or destroyed.
4. Establish replacements based on original survey control.

1.05 QUALIFICATIONS

A. Registered land surveyor of the discipline required for the specific service on the project, currently licensed in Florida.

1.06 SYSTEM DESCRIPTION

A. The Contractor shall establish a minimum of three permanent benchmarks, one at US 90 and two on the site, referenced to data established by survey control points:

1. Record locations, with horizontal and vertical data, on 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 placement.
b. Utility slopes and invert elevations.

2. Building foundation, column locations, and floor levels.

3. Controlling lines and levels required for mechanical and electrical trades.

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

D. Maintain a complete and accurate log of all control and survey work as the work progresses.

E. As a condition for approval of monthly progress payment requests, update the project record drawings daily then report monthly progress based on the work performed during the month ending at the pay request. The Contractor shall coordinate this monthly with the Owner's representative on the site as part of the pay request.

F. Maintain an accurate record of piping changes, revisions, and modifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730
CUTTING, CORING, AND PATCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all cutting, coring, fitting, and patching, including attendant excavation and backfill, required to complete the Work or to accomplish the following:

1. Make the Work's several parts fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Subcontract Documents.
5. Remove samples of installed work as specified for testing.
6. Provide routine penetrations of non-structural surfaces for installing piping and electrical conduit.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit a written request well in advance of executing any cutting or alteration that affects the following:

1. Work of the Owner or any other Contractor.
2. Structural value or integrity of any element of the Project.
3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
4. The efficiency, operational life, maintenance, or safety of operational elements.
5. Visual qualities of elements exposed to view.

C. The written request shall include the following:

1. Identification of the Project.

2. Description of affected Work.

3. The necessity for cutting, altering, or excavating.

4. The effect on the work of the Owner or any other Contractor or on the structural or weatherproof integrity of the Project.

5. Description of proposed Work:

   a. Scope of cutting, patching, alteration, or excavation.
   b. Trades which will execute the Work.
   c. Products proposed to be used.
   d. Extent of refinishing to be done.

6. Alternatives to cutting and patching.

7. Cost proposal, when applicable.

8. Written permission of any other Contractor whose work will be affected.

D. The Contractor shall submit written notice to the Engineer designating the date and the time the Work will be uncovered.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete and grout for rough patching shall be as specified in Division 3, Concrete.

B. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering Work, the Contractor shall inspect conditions affecting installation of products or performance of the Work.

C. The Contractor shall report unsatisfactory or questionable conditions to the Engineer in writing and shall not proceed with work until the Engineer has provided further instructions.

D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.

E. All holes cut through concrete and masonry walls, slabs, or arches shall be core-drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer, and all such cutting shall be done in a manner directed by the Engineer. No holes shall be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

F. Rough patching shall be such as to bring the cut or cored areas flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to ensure the structural value or integrity of the affected portion of the Work.

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

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

D. Perform coring with an approved non-impact rotary tools with diamond core drills. The size of the holes shall be suitable for pipe, conduit, sleeves, and equipment or mechanical seals to be installed.

E. Ensure that all equipment conforms to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring, and maintenance.

F. Provide protection for existing equipment, utilities, and critical areas against water or other damage cause by drilling operation.

G. Following drilling, vacuum or otherwise remove from the area all slurry or tailings resulting from coring operations.

3.03 PERFORMANCE

A. Cut and demolish by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Excavate and backfill by methods which will prevent settlement or damage to other work.

C. Employ the original installer or fabricator to perform cutting and patching for the following:

1. Weather-exposed or moisture-resistant elements.
2. Sight-exposed finished surfaces.

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

E. Cut with a concrete wall saw and diamond saw blades of proper size.

F. Control slurry generated by sawing operation on both sides of wall.

G. When cutting a reinforced concrete wall, cut so as not to damage the bond between the concrete and reinforcing steel left in structure. Make the cut so that steel neither protrudes nor is recessed from the face of the cut.

H. Install adequate bracing of the area to be cut before cutting starts. Check the area during sawing operation for partial cracking and provide additional bracing as required to prevent a partial release of the cut area during sawing operations.

I. Provide equipment of adequate size to remove cut panel.

J. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Subcontract Documents.

K. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

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

1. For continuous surfaces, refinish to the nearest intersection.
2. For an assembly, refinish the entire unit.

M. Provide for Proper Pavement Restoration: The Contractor shall restore existing paving, including underdrains if any are encountered and broken into, and shall replace or rebuild the paving using the same type of construction as was in the original. The Contractor shall be responsible for restoring all such work, including subgrade and base courses, where present. The Contractor shall obtain and bear the expense of such local or other governmental permits as may be necessary.

END OF SECTION

SECTION 01735
CONTROL OF WORK

PART 1 GENERAL

1.01 PLANT

A. The Contractor shall furnish plant and equipment, which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress that will ensure the completion of the work within the Contract Time. If at any time the Plant appears to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress stated above, the Engineer may order the Contractor to increase the efficiency, change the character, or increase the plant and equipment and the Contractor shall conform to such an order. Failure of the Engineer to give such an order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

A. Do not enter or occupy private land outside of easements, except by permission of the landowner.

1.03 PIPE LOCATIONS

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

1.04 OPEN EXCAVATIONS

A. Adequately safeguard all open excavations by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workers. Remove bridges provided for access during construction when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. If the excavation becomes a hazard or if it excessively restricts traffic at any point, the Engineer may require special construction procedures, such as limiting the length of the

open trench, prohibiting stacking excavated material in the street, and requiring that the trench be closed overnight.

B. Take precautions to prevent injury to the public due to open trenches. Provide adequate light at all trenches, excavated material, equipment, or other obstacles that could be dangerous to the public at night.

1.05 TEST PITS

A. Excavate test pits, at the direction of the Engineer, to locate underground pipelines or structures in advance of the construction. Backfill test pits immediately after their purpose has been satisfied and restore and maintain the surface in a manner satisfactory to the Engineer.

1.06 MAINTENANCE OF TRAFFIC

A. Unless permission to close a street is received in writing from the proper authority, place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the construction operations cause traffic hazards, repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.

B. Maintenance of traffic shall be in accordance with Florida Department of Transportation (FDOT) District 2 guidelines. Detours around construction will be subject to the approval of the Owner and the Engineer. Where detours are permitted, provide all necessary barricades and signs as required to divert the flow of traffic. Expedite construction operations while traffic is detoured. The Owner will strictly control periods when traffic is being detoured.

C. Take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

1.07 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for preserving all public and private property and use every precaution necessary to prevent damage to this property. 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, the Contractor shall restore such property to a condition similar or equal to that existing before the damage was done or make good the damage in other manner acceptable to the Engineer.

1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

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

B. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, gas, power, and sewers). The Contractor shall maintain services to buildings and pay costs or charges resulting from damage to such services.

C. Notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays, and legal holidays) before excavating in any public way. Also notify Sunshine State One Call of Florida, telephone 1-800-638-4097, at least 72 hours before starting work.

D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the County is required, the Engineer may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work under the General Conditions. If relocation of a privately owned utility is required, the Engineer will notify the Utility to perform the work as expeditiously as possible. The Contractor shall cooperate with the Engineer and Utility. No claim for delay will be allowed due to such relocation.

E. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be part of the work under the Contract and all costs associated shall be included in the Contract Price.

1.09 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may be allowed to use water for construction purposes. The cost to obtain water shall be included in the Contract Price.

B. The express approval of the Owner shall be obtained before water is used. Hydrants shall only be operated under the supervision of the Owner personnel.

C. Waste of water by the Contractor shall be sufficient cause for withdrawing the use of water.

D. The Owner shall only provide water for hydraulic testing of the largest water-bearing structure.

1.10 MAINTENANCE OF FLOW

A. Provide for the flow of sewers, drains, and water courses interrupted during the progress of the work, and immediately cart away and remove all deleterious and offensive matter. Discuss the entire procedure of maintaining existing flow with the Engineer well in advance of the interruption of any flow.

1.11 COOPERATION WITHIN THIS CONTRACT

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

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

1.12 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

A. During the Work, keep the site of operations as clean and neat as possible. Dispose of all residue resulting from the construction work and at the conclusion of the work remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations and leave the entire site of the work in a neat and orderly condition.

B. To prevent environmental pollution arising from the construction activities related to the performance of this Contract, comply with all applicable Federal, State, and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related sections.

C. Disposing of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by the Contractor will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The Contractor will be required to remove the fill and restore the area impacted at no increase in the Contract Price.

1.13 SPECIAL WORK HOUR LIMITATIONS

A. The Contractor shall limit hours of operation in accordance with Section 01100, Summary of Work. No work shall be performed at night, on Sundays, or on legal holidays except in cases of emergency. The Engineer must authorize all exceptions to this work-hour limitation in writing.

1.14 CHARACTER OF THE CONTRACTOR'S SUPERINTENDENT AND WORKERS

A. The Contractor's superintendent and project manager shall conduct themselves in a professional manner. If, in the opinion of the Owner and the Engineer, the superintendent and project manager do not conduct themselves in a professional and courteous manner, the Engineer can recommend to the Owner that the superintendent and/or the project manager be relieved of their responsibilities and removed from the project. Upon written notice from the Owner, the Contractor shall immediately remove the superintendent and/or the project manager of their responsibilities and removed from the project. The work of this project must be conducted under the supervision of a full-time superintendent.

B. Any person employed by the Contractor or by any subcontractor who in the opinion of the Engineer does not conduct him/herself in a professional and courteous manner or is intemperate or disorderly, shall at written request of the Engineer, be removed immediately by the Contractor or subcontractor employing such person, and that person shall not be allowed to work on any other portion of work in this Contract without written approval of the Engineer. Should the Contractor fail to remove such person(s) or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Engineer may recommend to the Owner that the work be suspended until compliance with such orders has been met. Contract time will not be stopped during this time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740
FINAL CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall execute cleaning during progress of the Work and at the completion of the Work as required by General Conditions.

1.02 ENVIRONMENTAL CONCERNS

A. Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

The Contractor shall do the following:

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 the manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

PART 3 EXECUTION

3.01 PERIODIC CLEANING

The Contractor shall do the following:

A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.

B. Provide onsite containers for the collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal areas away from the site.

3.02 DUST CONTROL

The Contractor shall do the following:

A. Clean interior spaces before the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

The Contractor shall do the following:

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior surfaces exposed to view.

C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

D. Before final completion or Owner occupancy, inspect interior and exterior surfaces exposed to view and all work areas to verify that the entire Work is clean.

END OF SECTION

SECTION 01750
PLANT START-UP AND INITIAL OPERATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This work pertains to the Columbia County North Florida Mega Industrial Park Wastewater Treatment Plant start-up.

B. The Contractor shall coordinate the work of this Section with the start-up and operation requirements identified in Section 11000, General Equipment Requirements.

1.02 SUBMITTALS

Before plant start-up, the Contractor shall meet with the Owner and Engineer to verify that each of the following tasks has been completed:

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. All final acceptance tests have been performed. See the appropriate forms in Section 11000, General Equipment Requirements.

C. Certified equipment is in compliance, as required, under Section 01600, Materials and Equipment.

D. All required lubrication equipment and materials have been provided. See the appropriate forms in Section 11000, General Equipment Requirements.

E. All piping and valves have been properly installed.

F. Existing County plant personnel have agreed that all of the plant components are ready for start-up.

G. All safety equipment has been installed and is fully functional.

H. All indicating and annunciating systems have been installed and are fully functional.

I. All utilities are operable.

J. All equipment O&M Instruction books have been provided to the Owner.

K. The required written report has been submitted, in accordance with Section 01330, Submittals and Acceptance, Section 01400, Quality Requirements, and this Section that all equipment has been properly installed and is ready for plant start-up.

1.03 TAGGING SYSTEM

A. The Engineer will provide a tagging system which will be used to establish prerequisites for Phase I plant start-up. The tagging system shall be as follows:

1. Preliminary check completed (*Field Testing* in Section 01600, Materials and Equipment).
2. Red Tag shall be placed on all items that have not received or passed final acceptance.
3. Final Acceptance Tests, including electrical, before Phase I Start-up (*Acceptance of Installation*, in Section 01600, Materials and Equipment).

B. Tags will be signed and dated by the Engineer upon acceptance and shall remain attached to the item until ordered removed by the Engineer.

C. Phase I shall not be started up until all equipment required for use or listed in Table 11000-1 in Section 11000, General Equipment Requirements, has been cleared of Red Tags.

1.04 MANUFACTURER'S INSTRUCTIONS

A. Training for Owner staff by manufacturer's representatives (Table 11000-1 in Section 11000, General Equipment Requirements) shall be scheduled during start-up and the initial operation period. Laboratory instructions, if applicable, shall be provided during the first week of start-up. Contractor to submit a tentative schedule of Owner training to the Engineer for review with the Owner's operating personnel 2 weeks before the proposed start-up date. An equipment manufacturer who has supplied several items of equipment may combine instructions on two or more items on the same day, with follow-up visits within 6 months so that the total number of days is in accordance with the Specifications. Instruction from more than one equipment manufacturer shall not be permitted on the same day. Items requiring instructional visits are listed in the individual Specification Sections and/or Section 01600, Materials and Equipment, or Section 11000, General Equipment Requirements.

1.05 COORDINATING CONFERENCE

A. At least 14 days before plant start-up, a coordinating conference shall be held to establish start-up procedures which are to be followed, to determine the status of all equipment, and generally to coordinate all aspects of this phase of the project. Representatives of the Owner, Engineer, and Contractor(s) shall attend the conference. The Contractor shall make all shop drawings, manuals of instruction and maintenance for equipment, and the Contract Documents available for reference.

1.06 CONTRACTOR'S OPERATING PERSONNEL

A. In addition to personnel required to carry out the routine and non-routine operations, the Contractor shall assign to the plant one master mechanic who is thoroughly familiar with the plant equipment and construction. The Contractor's master mechanic shall be assigned to the plant 8 hours a day 5 days a week during the entire period of the plant start-up and initial operation until the "Date of Substantial Completion." The master mechanic shall be available on call during the entire remaining hours and days of Plant Start-Up and Initial Operation, when not directly on duty at the plant. In addition to orienting and assisting the plant operators, the mechanic shall make minor adjustments to equipment if necessary. The mechanic shall help the operators establish a regular schedule for lubrication of all equipment and shall also demonstrate the techniques of lubrication. The master mechanic's prime responsibility shall be the plant's operation. During the initial operation period, the master mechanic shall be devoted full-time to the operation of the plant. During other times, the master mechanic may be concerned with other aspects of the Contractor's work, as time permits; however, the mechanic's prime responsibility shall be the plant's operation.

B. The Electrical Sub-Contractor shall assign one master electrician to the plant 8 hours a day during the first week (7 days) of plant start-up and initial operation. The Electrical Sub-Contractor's master electrician shall be available on call during the remaining hours of the first 7 days and during the entire remainder of the plant start-up and initial operation periods. The electrician shall make any adjustments required of the equipment under this contract and shall assist the plant operator in the operation and maintenance of the electrical equipment.

C. The Instrumentation & Control (I&C) Sub-Contractor shall assign one master System Control and Data Acquision (SCADA) technician to the plant 8 hours a day during the first week (7 days) of plant start-up and initial operation. The I&C Sub-Contractor's SCADA technician shall be available on call during the remaining hours of the first 7 days and during the entire remainder of the plant start-up and initial operation periods. The technician shall make any adjustments

required of the equipment under this contract and shall assist the plant operator in the operation and maintenance of the instrumentation and control equipment.

D. The Heating and Ventilating and Plumbing Sub-Contractors, if applicable, shall each assign a master mechanic to the plant 8 hours a day during the first 7 days of initial start-up operations. These master mechanics shall be available on call for the remaining hours of the first 7 days and during the entire remainder of the plant start-up and initial operation periods.

E. The master electrician and mechanics on call shall be capable of arriving at the plant within 4 hours of being requested.

F. Analysis to monitor plant performance shall be performed by Owner's personnel.

1.07 MATERIALS, SUPPLIES, AND UTILITIES

A. Chemicals

1. The Contractor shall be responsible for the cost of chemicals required for testing, construction activities, and abnormal quantities needed as a result of disruption of facilities or as a result of temporary facilities needed by the Contractor. Chemicals to be provided following start-up and testing include but are not limited to the following:

   a. 5,000 gallons of sodium hypochlorite (for reduced startup capacity).
   b. 300 gallons of Micro-C (supplemental carbon tote).
   c. DOW Anti-Foam.

B. Special tools for maintenance and minor repairs, spare parts, etc., shall be furnished in accordance with other sections of the Specifications. The Contractor's mechanics shall have adequate tools on hand to supplement the requirements of this Section.

C. The Owner will provide all electric, natural gas, and other utilities required during the Treatment Plant Start-Up and Initial Operation until the issuance of the Certificate of Substantial Completion.

D. The Contractor shall submit for the Engineer's approval a proposed plan for transferring "seed" sludge from an existing sewage treatment plant to be used in "starting up" the new treatment plant. The Contractor shall coordinate the quantity with the Owner and Engineer and, at his own expense, transfer the appropriate gallons of "seed sludge."

E. Fuel/Diesel Oil

1. The Contractor is responsible for all costs associated with construction activities until substantial completion.
2. The Contractor shall provide one full tank load of diesel fuel oil for ballast and testing each new emergency generator.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01755
EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, Equipment, 13, Special Construction, 15, Mechanical, and 16, Electrical, to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing, and startup of the equipment.

B. The Contractor shall perform specified equipment field performance tests, final acceptance tests, and startup services.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit name, address, and résumé of proposed field services technicians at least 30 days in advance of the need for such services.

B. Submit for review detailed testing procedures for shop tests, field performance tests, and final acceptance tests as specified in the various equipment specification sections. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:

1. Name of equipment to be tested, including reference to specification section number and title.
2. Testing schedule of proposed dates and times for testing.
3. Summary of power, lighting, chemical, water, sludge, gas, etc., needs and identification of who will provide them.
4. An outline of specific assignments of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
5. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods).
6. Samples of forms to be used to collect and record test data and to present tabulated test results.

C. Submit copies of test reports upon completion of specified shop, performance, and acceptance tests. Test reports shall incorporate the information provided in the test procedures submittals, modified to reflect the actual conducting of the tests and the following additional information:

1. Copies of all test data sheets and results of lab analyses.
2. Summary comparison of specified test and performance requirements vs. actual test results.
3. Should actual test results fail to meet specified test and performance requirements, a description of actions to be taken before re-testing the equipment.

D. Submit copies of the manufacturer's field service technician's report summarizing the results of the initial inspection, operation, adjustment, and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified in this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. AWWA C653—Disinfection of Water Treatment Plants.

B. American Society for Testing and Materials (ASTM)

C. Water Pollution Control Federation (WPCF)

1.04 QUALITY ASSURANCE

A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing, and startup of the equipment and systems being installed.

B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

A. After the equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the manufacturer's field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracks or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.

B. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of his/her inspection, operation, adjustments, and tests.

3.02 WITNESS REQUIREMENTS

A. Shop tests or factory tests may be witnessed by the Owner and/or the Owner's representatives, as required by the various equipment specifications.

B. Field performance and acceptance tests shall be performed in the presence of the Owner, the Owner's designated personnel, and/or the Owner's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE TREATMENT PLANT AND RELATED SYSTEMS

A. General Requirements

1. Successfully execute the step-by-step procedure of startup and performance demonstration specified in this Section.
2. The startup and performance demonstration shall be successfully executed before Substantial Completion and acceptance by the Owner of the treatment plant and its related systems.
3. All performance tests and inspections shall be scheduled at least 5 working days in advance or as otherwise specified with the Owner and

the Engineer. All performance tests and inspections shall be conducted during Monday through Friday, unless otherwise specified.

B. Preparation for Startup

1. Upon completion of the wastewater treatment facility and all its related systems, all channels, basins, and tanks shall be flushed with reclaimed water and hydraulically checked for leaks, cracks, and defects in accordance with Section 01810, Watertightness Test for Hydraulic Structures.
2. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be cleaned and purged as required. All sumps, tanks, basins, chambers, pump wells, and pipelines which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.
3. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.
4. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment facilities for proper operation.
5. No testing shall be conducted or equipment operated until the Engineer has verified that all specified safety equipment has been installed and is in good working order.
6. No testing shall be conducted or equipment operated until the Engineer has verified that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

C. Facilities Startup

1. The startup period shall not begin until all new treatment facilities and equipment have been tested as specified and are ready for operation. The Owner shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data, and the specified operation and maintenance instruction before the startup with wastewater. All valves shall be tagged before this startup.

2. Demonstrate 7 consecutive 24-hour days of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance.

3. If the facility fails to demonstrate satisfactory performance on the first or any subsequent attempt, the Contractor shall make all necessary

alterations, adjustments, repairs, and replacements. When the facility is again ready for operation, it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facility has operated continuously to the satisfaction of the Owner and Engineer for the specified duration.

4. The Owner will furnish all operating personnel (other than vendor's or subcontractor's service personnel) needed to operate equipment during the final test period; however, these personnel will perform their duties under the Contractor's direct supervision. Until performance tests are completed and units and systems are accepted by the Owner as substantially complete, the Contractor shall be fully responsible for the operation and maintenance of all new facilities.

5. The Owner will provide the necessary water to test one 250,000-gallon equalization tank. That water should be moved around to test the other tanks on site. However, the Contractor shall provide all necessary chemicals, electricity, and personnel of the various construction trades, i.e., electricians, plumbers, etc., and field service personnel of the major equipment suppliers on an 8-hour-per-day basis at the facilities and on a 24-hour-per-day basis locally during the startup period. Major equipment suppliers shall include but not be limited to the following:

    a. Pumping Equipment.
    b. Instrumentation and Control Systems, including Programmable Controllers.
    c. Blowers.
    d. Diffusers.
    e. Heating, Ventilating, and Air-Conditioning Systems.
    f. Aerators.
    g. Switchgear.
    h. Slide Gates.
    i. Motorized Valves.
    j. Electric Motors.
    k. Motor Control Centers.
    l. Emergency Generator.
    m. Flow Meters.
    n. Analyzers.

6. At no time during startup shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

END OF SECTION

SECTION 01770
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SUBSTANTIAL COMPLETION

A. When the Contractor considers that the Work or designated portion of the Work is Substantially Complete, the Contractor shall submit written notice to the Engineer with a list of items to be completed or corrected.

B. If the Engineer's review finds that the Work is not substantially complete, the Engineer will promptly notify the Contractor in writing, listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.

D. When the Engineer finds the Work is Substantially Complete, the Engineer will prepare a Certificate of Substantial Completion.

1.02 FINAL COMPLETION

A. When the Contractor considers that the Work or designated period of the Work is complete, the Contractor shall submit written certification to the Engineer indicating the following:

1. The Contract Documents have been reviewed.
2. The Work has been reviewed for compliance with the Contract Documents.
3. The Work has been completed in accordance with the Contract Documents and deficiencies listed with Certificates of Substantial Completion have been corrected.
4. The Work is complete and ready for final inspection.
5. All required shop drawings, catalog cuts, operations and maintenance manuals, instruction manuals, test reports, samples, spare parts, training, and all other submittals have been submitted and reviewed by the Engineer.
6. All deliverables have been delivered or placed as accepted by the Engineer.

B. If the Engineer's review reveals that the Work is incomplete, the Engineer will promptly notify the Contractor in writing listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second certification of Final Completion.

D. When the Engineer finds that the Work is complete, the Engineer will consider closeout submittals.

1.03 ADDITIONAL REVIEW FEES

A. If the status of Completion of Work requires more than two reviews of the Work by the Engineer due to failure of the Work to comply with the Contractor's claims on the first and second reviews, the Owner will deduct from the final payment to the Contractor the amount of the Engineer’s compensation for additional review services.

1.04 CLOSEOUT SUBMITTALS

A. Evidence of Compliance with Requirements of Governing Authorities:

1. Certificate of Occupancy.
2. All required Certificates of Government Inspections.

B. Operation and Maintenance Manuals: Under provisions of Section 01830, Operations and Maintenance Manuals.

C. Record Documents: Under provisions of Section 01785, Record Documents.

D. Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract.

E. Consent of Surety to Final Payment.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:

1. Original total Contract Price.
2. Previous change orders.
3. Changes under allowances.
4. Changes under unit prices.
5. Deductions for uncorrected Work.
6. Penalties and bonuses.
7. Deductions for liquidated damages.

8. Deductions for Engineer's additional review fees.
9. Other adjustments to total Contract Price.
10. Total Contract Price as adjusted.
11. Previous payments.
12. Sum remaining due.

B. Upon the Owner's review and approval, the Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.06 APPLICATION FOR FINAL PAYMENT

A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Compile specified warranties and bonds.
B. Co-execute submittals when so specified.
C. Review submittals to verify compliance with Contract Documents.
D. Submit submittals to the Owner for review.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Assemble warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: two each.

C. Table of Contents: Neatly typed, in sequence of the Specifications. Provide completion information for each item as follows:

1. Product or work item.

2. Firm, address, telephone and fax numbers, and name and email of principal.

3. Scope.

4. Date of beginning of warranty, bond, or service and maintenance contract.

5. Duration of warranty, bond, or service and maintenance contract.

6. Provide information for Owner's personnel:

a. Proper procedure in case of failure.
b. Instances that might affect the validity of warranty or bond.

7. Contractor, with address, telephone and fax numbers, and the name and email of responsible principal.

D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.

E. The Contractor's obligation to correct defective or nonconforming Work shall run for 1 year (or such longer period may otherwise be specified in the Contract Documents) beginning from the date Substantial Completion is achieved.

1.03 WARRANTIES

A. All mechanical and electrical equipment together with devices of whatever nature and all components which are furnished and/or installed by the Contractor shall be guaranteed.

B. The warranty shall guarantee against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.

C. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness without increase in the Contract Price. If the Contractor fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01785
RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section details the minimum requirements for the Contractor for maintenance and recording of Record Documents and Record Drawings.

B. The Contractor shall retain the services of a State of Florida licensed Professional Land Surveyor (PLS) to prepare Record Drawings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance, and record documents as specified below:

A. The Contractor shall institute a computerized record control program.

B. The Contractor shall make documents and samples available at all times for inspection by the Owner.

C. The Contractor shall submit to the Owner the name and address of the licensed PLS, along with the following:

1. Documentation of current State of Florida licensure as a PLS.
2. Documentation of a current State of Florida business license to practice surveying.
3. Documentation demonstrating three projects within the past 5 years where the surveyor performed field engineering and record drawing preparation using AutoCAD 2018 or later for projects of a similar type and size as the work covered by the Contract Documents.

D. At Substantial Completion, the Contractor shall submit for review and approval all Record Documents including Record Drawings with cover letter to the Owner, listing the following:

1. Date.
2. Project Title and Number.
3. Contractor’s Name and Addresses.
4. PLS name and Florida license number.
5. Number and Title of each Record Document.

6. Electronic file names.
7. Signature of Contractor or its Authorized Representative.
8. Contract Section and Subsection numbers.
9. Location.

E. Before assembling and submitting records, the Contractor shall review for completeness the records maintained by its subcontractors.

F. Submit three sets of hard copy record drawings and electronic record drawings in PDF format, prepared and printed from updated AutoCAD contract drawings as discussed in this Section to the Owner for review and comment or approval. Deficiencies in the Record Drawings shall be corrected before final payment and contract closeout. Printed and electronic transmittals shall be clearly labeled with the appropriate project number, client name, date, and file names. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.

G. Final Record Drawings shall be signed and sealed by the PLS. Electronic Record Drawing submittals in PDF format shall be digitally signed and sealed in accordance with State of Florida requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROJECT RECORD

A. The Contractor shall label and file Record Documents and samples in accordance with the corresponding Specification Section number. Each document shall be labeled “PROJECT RECORD” in neat, large, printed letters. Record Documents shall be maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes.

3.02 RECORDING

The Contractor shall record construction information as follows:

A. Record and update daily Record information from field notes on a set of opaque Contract Drawings and to the satisfaction of the Owner.

B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.

C. Record information concurrently (daily) with construction progress. Work shall not be concealed until required information is recorded.

D. The Contractor shall present the field logbook containing swing tie information and red-lined as-built drawings at each monthly construction meeting for review by the Owner. Failure to produce adequate as-built information will be grounds for withholding appropriate funds from the monthly payment applications.

E. The Contractor's PLS shall perform all field surveying and Computer Assisted Design (CAD) Drawing preparation in AutoCAD necessary to prepare signed and sealed (certified) Record Drawings for all site improvements (stormwater, paving, grading, utilities, building corners, structures, signs, other surface and subsurface improvements, etc.) as detailed herein, as well as elsewhere in the Contract Documents and as may be required by applicable permits for as-built certification and closeout.

F. The Contractor shall perform all other field recording for facilities and other improvements not covered by the PLS, and prepare CAD Drawings in AutoCAD showing as-built conditions of the improvements constructed under this project.

3.03 RECORD DRAWINGS

A. Record Drawings shall be a special revision of the construction drawings and shall reflect the following:

1. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
3. Field changes of dimension and detail.
4. Changes made by modifications.
5. Top-of-wall elevations, northing and easting coordinates, and slab elevations of all new and modified structures.
6. For underground piping, northing and easting coordinates of valves elbows, tees, and invert elevations.
7. Details not on original construction drawings.
8. At locations where a top-of-pipe elevation or centerline is required for pipeline, a top-of-ground or top-of-pavement elevation shall also be measured and noted on the Drawings.
9. On Record Drawings, at locations where the horizontal or vertical dimensions of constructed pipelines, structures, equipment, and other improvements deviate from the horizontal positions that were shown on the construction Drawings, the actual positions of the pipelines or structures shall be measured and redrawn to depict their actual positions

on the Record Drawings, and their original design positions shall be cross-hatched out, screened back to a lighter shade, or other notations to indicate the change between design and as-built.

10. Record information shall include a thorough description of the improvements that have been installed, including types of material, size, class, diameter, diameter ratio, deviations from the design, and other basic information.
11. For new valves, the manufacturer type (e.g., gate, plug, ball), size (pipe nominal diameter), and make (manufacturer) of each valve shall be noted on the Record Drawings.
12. The drawings scales used in the Record Drawings shall be the same as were used in the Contract Drawings, and the sheet number of each Record Drawing sheet shall be the same as the sheet numbers that were used on the Contract Drawings from which the Record Drawings originate.
13. Record Drawings shall accurately depict all existing improvements lying within the immediate vicinity of the constructed facilities. Existing improvements shall include but not be limited to sidewalks, fences, road surfaces, buildings, and other utilities. Immediate vicinity includes areas within utility easements, right-of-way corridors, and also includes areas within 15 feet of new potable water mains, force mains, gravity sewer mains, storm pipes, power and communications lines, gas piping, and other utilities. Immediate vicinity also includes areas within 10 feet of potable water meters, backflow preventers, and fire hydrants. Rights-of-way, easements, and property corners shall be shown and shall be of sufficient detail as to confirm that constructed facilities are within appropriate property boundaries, easements, or rights-of-way. A reference to the recording document (O.R. Book or Plat Book and Page) shall be included with any depiction of a right-of-way, easement, or property boundary.
14. Each roadway depicted on the Drawings shall have the correct roadway name noted on it.
15. Horizontal locations required for valves, fittings, services, and other utility structures shall be to the center of each installation. Top-of-ground or pavement elevations required along pipelines shall be reported to the nearest 0.1 foot. Top-of-pipe elevations shall be reported to the nearest 0.1 foot. Elevations of manhole rims and manhole pipe inverts shall be reported to the nearest 0.1 foot. Top-of-wall elevations shall be reported to the nearest 0.02 foot. Weir and gate elevations shall be reported to the nearest 0.02 foot.
16. All sheets that were used to depict locations and elevations of utility structures in the Construction Drawings shall be included in the Record Drawings set.
17. Record information shall be presented in a clear and comprehensible form.

18. Abandoned-in-place water main pipe shall be shown in their actual positions.

B. CAD Requirements for Record Drawings: The Contractor shall, upon completion of the work, provide the Owner with a complete set of Record Drawings that includes as-built information updated in AutoCAD on the original Contract Drawings. The Record Drawings shall include every drawing that is in the Contract Drawing set, plus any supplemental drawings necessary to convey the as-built information. Supplemental drawings shall use the same title block as the other Record Drawings with supplemental unique page numbers. No additional compensation will be allowed for the Contractor to provide the Record Drawings. The Contractor shall use the AutoCAD drawings furnished by the Owner for this purpose. Record Drawings must be submitted in the AutoCAD format of the Contract Drawings. No other CAD software or format will be accepted. The Contractor is solely responsibility for ensuring that the Record Drawings conform to the following CAD requirements:

1. All changes to drawings must be done in accordance with the same scale of the drawing revised and shall be delineated by placing a "cloud" around the areas revised and adding a revision triangle indicating the appropriate revision number.
2. Each drawing must have the revision block completed to indicate the revision number, date, and initials of the person revising the drawing. The description of the revision must say "Record Drawing." This procedure must be followed for every drawing even when no changes are made to the drawing.
3. All revisions to drawings must be put on separate layers with the layer names prefixed Record followed by the appropriate existing layer name. The colors and line types of the appropriate existing layers shall be adhered to when creating new layers.

C. The Contractor’s PLS shall sign and seal the Record Drawings certifying them as true, accurate, correct, and complete, and that all data were collected in the field by the PLS or by a representative under the direct supervision of the surveyor. All visible record features, including sewer and drainage inverts, must be measured and located by the surveyor or by personnel under his or her direct supervision. The certifying surveyor shall be fully responsible for the accuracy of the record locations and elevations shown on the Record Drawings.

1. The Contractor’s surveyor shall resurvey all visible surface structures as part of the Record Drawings submittal, including, but not limited to, valve boxes, hydrants, relocated or new water meter boxes, automatic blow-off assemblies, walls, gates, and weirs.
2. Horizontal locations shall be tied to Geodetic Datum (NAD) 83.

3. Elevations shall be tied to North American Vertical Datum (NAVD) 88. Elevations tied to National Geodetic Vertical Datum (NGVD) 29 shall be converted to NAVD 88.

D. Record Drawings for facilities and other improvements not covered by their PLS shall be signed by the Contractor certifying the Record Drawings as being an accurate representation of as-built conditions. The Owner reserves the right to reject record drawings that do not accurately represent as-built conditions, and the Contractor shall be responsible for correcting the record drawings at no additional cost to the Owner.

END OF SECTION

SECTION 01810
WATERTIGHTNESS TEST FOR HYDRAULIC STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required and perform tightness testing of water-containing structures as listed in this Section and all retesting until the structures meet the requirements as specified in this Section.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit to the Engineer the results of each watertightness test of each structure. The submittal format shall be similar to that shown in Figure A attached to the end of this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. The testing of prestressed concrete and reinforced concrete tanks or water containment structures shall conform to the following standards and as modified in this Section:

1. American Concrete Institute (ACI)

a. ACI 344R-W—Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures.
b. ACI 344R-T—Design and Construction of Circular Prestressed Concrete Structures with Circumferential Tendons.
c. ACI 350.1—Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures (ACI 350.1-10) and Commentary.

2. American Water Works Association (AWWA)

a. AWWA D110—Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

1.04 QUALITY ASSURANCE

A. Coordinate timing and procedures for obtaining testing water and structure testing with the Owner well in advance of the actual testing.

B. Water Source and Disposal

1. Water for testing shall be provided by the Owner.
2. Water shall be potable water. The Contractor shall supply all labor, equipment, and materials.
3. Test water shall be disposed of by the Contractor in an approved manner. Water shall not be disposed of by discharging it onto the ground surface of public or private land.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall prepare structures for testing as follows:

1. Inspect the structure to be tested for potential leakage paths such as cracks, voids, etc. and repair any leakage paths in compliance with the provisions specified in this Section or as approved by the Engineer.
2. Thoroughly clean the structure to be tested of dirt, mud, and construction debris before beginning watertightness tests. The floor and sumps shall be flushed with water to provide a clean surface ready for testing.
3. Inlet and outlet pipes not required to be operational for the tests may be temporarily sealed or bulkheaded before testing.
4. Confirm the adequacy of seals around valves and reset or seal as approved by the Engineer. Estimates of valve leakage will not be allowed as adjustments to the measured tank or structure leakage.

B. The Contractor shall perform watertightness tests before backfilling around structures to allow observing and detecting leakage points. Walls may be backfilled before testing only when approved in writing by the Engineer. The request to backfill before testing shall include a description of the method proposed to detect leakage points after the backfill is in place. Approval to place

backfill before testing shall not relieve the Contractor of the responsibility of conducting watertightness tests.

3.02 TESTING PROCEDURES

A. Conditions of Testing

1. The Contractor shall not begin initial filling of concrete structures until all concrete elements of the structure have attained the designed compressive strength of the concrete nor less than 14 days after all concrete walls or base slabs have been placed.
2. Initial filling of reinforced concrete structures shall not exceed a rate of 4 feet in 24 hours.
3. The Contractor shall fill unlined or partially lined concrete structures to the maximum operating water surface level and maintain the water at that level for at least 72 hours before beginning watertightness tests to minimize water absorption into the concrete during testing. The testing of fully lined concrete structures may be started as soon as the structure is filled.

B. Testing Procedures

1. The duration of the test shall not be less than that required for a drop in the water surface of 1/2 inch based on the calculated maximum allowable leakage rate for 3 days.
2. Loss-of-volume measurements shall be taken at 24-hour intervals. The loss of volume is usually determined by measuring the drop in water surface elevation and computing the change in volume of the contained water. Measure water surface elevation at not less than two locations at 180º apart and preferably at four locations 90º apart. Record water temperature 18 inches below the water surface when taking the first and last sets of measurements.

C. Reports

1. Submit to the Engineer watertightness test results for each structure tested on the form shown in Figure A or a form with a similar format.
2. Notify the Owner and Engineer of the scheduling of tests 3 working days before the tests. The Engineer and Owner may monitor any watertightness testing performed on the structures.

3.03 ACCEPTANCE

A. The following conditions shall be considered as NOT meeting the criteria for acceptance regardless of the actual loss of water volume from the structure:

1. Groundwater leakage into the structure through floors, walls, or wall-floor joints.
2. Structures that exhibit flowing water from joints, cracks, or from beneath the foundation (except for underdrain systems).
3. Lined concrete structures or prestressed concrete structures on which moisture can be picked up by a dry hand from the exterior surface of the walls.

B. The watertightness of concrete tanks and structures shall be considered acceptable when loss of water volume is within the criteria listed below:

1. For unlined tanks with a sidewater depth of 25 feet or less, loss of volume not exceeding 0.1% in 24 hours.
2. For tanks with lined walls and a sidewater depth of 30 feet or less, loss of volume not exceeding 0.06% in 24 hours. Steel diaphragms in concrete walls shall be considered the same as a wall liner.
3. For completely lined tanks, loss of volume not exceeding 0.025% in 24 hours.

3.04 REPAIRS AND RETEST1NG

A. The Contractor may retest structures failing the watertightness test and not exhibiting visible leakage after an additional stabilization period of 7 days. Tanks failing this second test shall be repaired before further testing.

B. The Contractor shall repair structures which fail the watertightness test and structures showing visible leakage in compliance with the provisions specified in this Section or as approved by the Engineer.

C. Repairs and retesting of tanks shall be accomplished at no additional cost to the Owner.

3.05 SCHEDULE

A. The following structures, where applicable, shall be tested for watertightness:

1. Chlorine Contact Basins (2).
2. Transfer Pump Station.

3. Influent Pump Station Wet Well.
4. Plant Drain Pump Station Wet Well.
5. BNR Package Plant Tanks (2).
6. Leachate Tanks (2).
7. Manholes.
8. Chemical Storage Tanks (2).
9. Chemical Storage & Handling Containment Facility.
10. Effluent Storage Pond.

FIGURE A
WATERTIGHTNESS TEST REPORT

PROJECT _____ SUBMITTED BY_____

STRUCTURE* _____ TEST DATES_____

Allowable loss of water volume _____ percent in 24 hours.

Measured loss of water volume _____ percent in 24 hours.

TEST READINGS

Water temperature at start _____degrees F. Water temperature at end _____degrees F.

Date	Time	Location 1	Location 2	Location 3	Location 4	Initials
1. _____	_____	_____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____	_____

Change in level _____

Average change in level _____

Correction for precipitation/evaporation _____

Corrected change in level = CL = _____

$\frac{(CD \times (\text{surface area}) \times (100)}{(\text{initial water volume}) \times (\text{number of test days})}$ = measured percent water loss in 24 hours.

Notes and field observations**

_____

_____

* Attach a sketch showing a plan of the structure and measurement locations.

** Place date and initials at the beginning of each entry.

END OF SECTION

SECTION 01815
SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall schedule his operations to conform to the requirements specified herein and shall include in his construction schedule all events that will impact construction of treatment facilities.

B. The Contractor shall fully cooperate with the Owner, coordinate the construction schedule with the Owner and Engineer, and provide the necessary labor, equipment, and materials to prevent interruption to construction. The Owner and Engineer reserve the right to modify or expand the schedule during construction to meet prevailing conditions.

C. The work specified in this Section shall be accomplished at such times that will be convenient to the Owner. Overtime work by the Contractor to conform to these requirements shall be considered as normal procedure under this Contract, and the Contractor shall make no claim for extra compensation as a result of this overtime work.

D. To maintain continuous construction, a phased removal and construction sequence shall be required. Specific constraints are outlined in this Section. The Contractor shall submit to the Engineer a detailed sequence of construction to complete the work while maintaining construction.

E. The Contractor shall furnish all temporary materials and equipment that may be required to complete the work of this Contract.

1.02 SUBMITTALS

The Contractor shall submit a sequence of construction plan and schedule in accordance with Section 01330, Submittals and Acceptance:

A. Submit a complete description of procedures to maintain the construction schedule developed. The description shall include step-by-step procedures, required duration, and specific procedures required to be performed by the Owner’s personnel, if applicable.

B. Submit complete plans of temporary systems required as part of this contract to maintain plant operations. The plans shall clearly delineate the intended location

of these items and the Contractor's proposed method for phasing from existing to temporary to completed facilities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The following constraints shall be applied to all equipment, treatment units, and appurtenances and utility systems on the plant site.

1. Vehicular access to the plant site and to all treatment units shall be maintained at all times.

2. Potable water supply to the plant shall remain operational at all times.

3. Sanitary facilities shall remain operational at all times.

4. Electric power and lighting service shall be uninterrupted.

5. Before making a change in existing piping, electrical, or control systems, the Contractor shall inform the Owner and Engineer of such change.

6. All temporary facilities provided by the Contractor must be demonstrated to be operational to the satisfaction of the Engineer. Availability of these facilities must be maintained at all times. The Contractor must respond to requests from the Engineer for repair and maintenance immediately (7 days per week, 24 hours per day, including holidays). If the Contractor fails to immediately respond to requests for repair and maintenance, such repair and maintenance may be performed by the Owner. All costs associated with such repair and maintenance performed by the Owner shall be the responsibility of the Contractor.

END OF SECTION

SECTION 01820
TRAINING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Instruct and train the Owner's personnel in the operation and maintenance of the equipment and systems supplied and/or installed under this Contract.

B. Incorporate operation and maintenance data and training services furnished by the suppliers into the training program such as shop drawings, equipment manuals, and start-up engineering and training assistance.

C. Ensure that system suppliers provide a qualified training instructor to help the Contractor train the Owner's employees in the proper operation and maintenance of all equipment and systems.

D. Prepare instructors and training materials required for complete factory, field, classroom, and hands-on training.

E. Furnish training videos and manuals during the training program.

F. Include in the total Contract Price the cost for training equipment; preparing training manuals; conducting classroom instructions; performing field, factory, and hands-on training; and coordinating and incorporating training service provided by suppliers and all other activities required to provide a comprehensive training program of sufficient length, as determined by the Owner.

1.02 WORK SEQUENCE

A. All factory training programs, if required, shall be completed before start-up of the Owner's system, and shall use equipment similar to the Owner's equipment.

B. The field training programs shall be conducted in accordance with the approved schedule.

C. Individuals requiring training shall be trained in small groups during Mondays through Fridays. The Contractor will normally provide training during the 8-hour dayshift.

D. The hands-on training shall be conducted with a maximum of 10 students per instructor.

E. The Contractor shall coordinate and submit a training schedule to the Engineer 30 days before the first training event.

F. The Contractor shall coordinate with the Owner regarding the training schedule. Multiple training sessions may be required to accommodate trainees from a different shift.

G. Each training session shall be a minimum of 8 hours unless specified otherwise in other sections.

1.03 QUALITY ASSURANCE

A. Preparation of training materials and instructions to be provided shall be performed by personnel:

1. Trained and experienced in operation and maintenance of equipment and systems installed under this Contract.
2. Familiar with the training requirements of the Owner.

B. The Contractor shall furnish résumés, including three outside references, for each instructor to be used in the training program.

C. The Engineer and Owner may review the résumés. Based on the review of the résumés and contacts with references, the Engineer shall approve, request additional information, or reject proposed instructors for the training program. If a proposed instructor is rejected, the Contractor shall submit the résumé and references of another candidate within a reasonable time.

1.04 TRAINING PLAN

A. The Contractor shall coordinate the training in accordance with this Section and Section 11000, General Equipment Requirements. At the completion of the Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for not less than 3 days to instruct permanent operating personnel in the operation of equipment and control systems.

B. At least 30 days before training, the Contractor shall submit to the Engineer a detailed training plan including the following:

1. Title and objectives.
2. Training schedule.

3. Prerequisite training and experience of attendees.
4. Recommended types of attendees (e.g., managers, engineers, operators, maintenance staff).
5. Course description and outline of course content.
6. Duration.
7. Location (e.g., training center or site).
8. Format (e.g., lecture, self-study, demonstration, hands-on).
9. Instruction materials and equipment requirements.

1.05 FORM OF TRAINING MANUALS

A. The Contractor shall prepare training packages in the form of an instruction manual for use by the Owner's personnel. At least 30 days before the training, the Contractor shall submit the training packages to the Engineer for acceptance.

B. Format

1. Size: 8 1/2 x 11 inches (21.59 x 27.94 cm).

2. Paper: 20-pound (9.072 kg) minimum, white, for typed pages.

3. Text: Manufacturer's printed data or neatly word processed including the following:

a. Table of contents.
b. Pretest.
c. Learning objectives.
d. General operations, theory, and specific equipment information.

4. Drawings

a. Provide reinforced punched binder tab, bind in with text.
b. Reduce larger drawings and fold to size of text pages, not larger than 11 x 17 inch (27.94 x 43.18 cm).

5. Cover: Identify each volume with the following:

a. Title of Project.
b. Identity of separate structure or system as applicable.
c. Identity of general subject matter covered in the manual.
d. Locations.

C. Binders

1. Commercial quality three-post binders with durable and cleanable plastic covers.
2. Maximum post width shall be 3 inches (7.62 cm).
3. When multiple binders are used, correlate the information into related consistent groupings.

1.06 VIDEOTAPED TRAINING MATERIAL

The Contractor shall do the following:

A. Produce or provide video training material subject to approval of the Owner.

B. Furnish four copies of each videotape in DVD format on a disc in a plastic case with the title, Owner's name, and time on a label.

C. Bear all costs associated with production and provision of the DVDs.

1.07 INSTRUCTIONS

A. At the completion of Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for a period of time as directed by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

B. The Contractor shall furnish four complete sets of operating instructions applying to each piece of equipment installed in conjunction with this Contract.

C. An "As-Installed" diagram of all control wiring and operating instructions shall be mounted in a watertight pocket on the inside door of the control panel of each unit.

D. Unless otherwise specified, the Contractor shall provide engraved metal, plastic tags, or instructions on any valve, switch, control, pipe or other piece of equipment which is not self-evident as to its function or mode of operation. This includes, but is not limited to, all exposed piping and all switches. This shall particularly apply to operations that must be manually sequenced.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01830
OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Compile product data and related information appropriate for the Owner's maintenance and operation of products furnished under the Contract.

1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of the Specifications. The data presented in the Operations and Maintenance (O&M) Manuals shall be specifically related to this Contract and application.
2. Incorporate maintenance and operation data furnished by the Owner, if any.

B. Furnish all labor, equipment, materials, and all other items to supply and deliver to the Owner O&M Manuals for the Work in accordance with the requirements of this Section.

C. Provide O&M Manuals for all equipment, including instrumentation, electrical, and process control system equipment and software for the entire Facility.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Manuals which, in general, shall have two levels: a facilities-wide systems level and an individual-component level.

1. The facilities-wide systems level shall do the following:

a. Describe the facilities-wide systems, including diagrams.
b. Explain start-up, shutdown, normal operations, and malfunctions of the facilities-wide systems.
c. Tabulate a lubrication schedule for the facilities-wide systems.
d. Describe preventive maintenance checking procedures for the facilities-wide systems.
e. Include a cross-reference to all individual component manuals.

2. The individual-component level shall contain the following:

    a. Storage requirements.
    b. Installation instructions.
    c. Alignment instructions and tolerances.
    d. Operating instructions.
    e. Troubleshooting instructions.
    f. Lubrication requirements.
    g. Maintenance instructions.
    h. Parts list.
    i. Recommended spare parts list and how to obtain same.

B. Format:

1. Electronic file format: PDF.

2. Size: 8 1/2-x-11-inch format for narrative and figures. Larger standard sizes are acceptable for drawings.

3. Text: Manufacturer's printed data or neatly word-processed.

4. Provide a new page for each separate product or each piece of operation equipment.

    a. Provide a word-processed description of the product and major component parts of equipment.
    b. Provide indexed tabs.

5. Cover: Identify each volume with the typed title, "OPERATION AND MAINTENANCE INSTRUCTIONS," listing the following:

    a. Title of Project.
    b. Identity of separate structure as applicable.
    c. Identity of general subject matter covered in the manual.

6. All word processing must be done using the latest version of Microsoft Word.

7. Arrange the data into related consistent groupings and cover all with a table of contents and index with page numbering of all sheets.

C. The Contractor shall submit the following:

1. Equipment Manuals—O&M Instruction Manual for each piece of equipment shall be submitted to the Owner with delivery of the equipment.
2. Systems O&M Manuals—Systems O&M Manuals, indexed and submitted to the Owner no later than 14 days before the Facility's start-up. Systems O&M Manuals will be complete except for field results and refinements added as result of demonstrations.
3. Final O&M Manuals—Final Equipment and Systems O&M Manuals, indexed and submitted to the Owner before the Substantial Completion under this Contract.
4. The cost of these Manuals shall be included in the total Contract Price.

D. Any modifications required after final O&M submission shall be made to the manuals by issuance of complete replacement O&M manuals. Addenda with pages for insertion into manuals previously provided are not allowed. The updated manuals shall be accompanied by a written description of the changes made to the manual.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Administrative Code (FAC)

1. Rule 62-600.410 FAC—Operation and Maintenance Requirements – Domestic Wastewater Facilities.

1.04 QUALITY ASSURANCE

A. Data shall be prepared by personnel:

1. Trained and experienced in maintaining and operating the described products.
2. Familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a person competent to prepare required drawings.

1.05 CONTENTS, EACH VOLUME

A. Neatly word-processed table of contents for each volume, arranged in systematic order, to include the following:

1. Contractor, name of responsible principal, address, fax number, and telephone number.

2. A list of each product required to be included, indexed to content of the volume.

3. A list with each product, name, address, fax number, and telephone number of the following:

   a. Subcontractor or installer.
   b. A list of each product to be included, indexed to content of the volume.
   c. Identify area of responsibility of each subcontractor or installer, if more than one.
   d. Local source of supply for parts and replacement.
   e. Manufacturer.

4. Identify each product by product name and other identifying symbols as set forth in the Contract Documents.

B. Product Data

1. Include only those sheets that are pertinent to the specific product.

2. Annotate each sheet to achieve the following:

   a. Clearly identify the specific product or part installed.
   b. Clearly identify data applicable information.
   c. Delete references to inapplicable information.

C. Drawings

1. Supplement product data with drawings as necessary to illustrate the following clearly:

   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
   c. Owner Tag Numbers.

2. Coordinate drawings with information in Record Documents to ensure correct illustration of completed installation.

3. Do not use Record Documents as maintenance drawings.

D. Written text as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
3. Describe how the complete system is to operate.

E. Copy of pertinent information related to warranty, bond, and service Contract issued.

1. Provide information sheet for Owner's personnel with the following information:

a. Proper procedures in event of failure.
b. Instances that might affect the validity of warranties or bonds.

F. Training manuals used in training courses will become part of this Manual.

1.06 MANUAL FOR MATERIALS AND FINISHES

A. 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 re-ordering special-manufactured 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 that are detrimental to product.
c. Recommended schedule for cleaning and maintenance.

B. Content, for moisture-protected 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.

C. Additional requirements for maintenance data as required by other sections of the Specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each electrical, mechanical, instrumentation, and communication system, as appropriate:

1. A table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument, and the function of the control or instrument.

2. A description of the system and its component parts:

a. Function, normal operating characteristics, and limiting conditions for the system, the sub-system, and the component parts.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial numbers of replaceable parts.

3. Circuit directories of panel board:

a. Electrical service.
b. Controls.
c. Communications.

4. As-installed color-coded wiring diagrams.

5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes.

a. An electrical schematic for each item.
b. A chart listing the controls/instruments in a loop identifying the equipment's abbreviated symbol, a description of the symbol,

design criteria, process flow, quantity supplied, and manufacturer's model and serial number.

6. Operating procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

7. Maintenance procedures:

    a. Routine operations.
    b. Guide to "trouble-shooting."
    c. Disassembly, repair, and re-assembly.
    d. Alignment, adjustment, and checking.

8. The manufacturer's operating and maintenance instructions.

9. A list of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

10. Other data as required under other sections of the Specifications.

11. Abnormal and emergency operations:

    a. Potential overloads.
    b. Procedures for equipment breakdown.
    c. Action to be taken in a power outage.
    d. Identity of alarms by equipment location and action to correct.
    e. Equipment safety features, requirements, and potential hazards.

12. Programming manuals for programmable devices including list of standard programming.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts:

    a. Function, normal operating characteristics, and limiting conditions.
    b. Performance curves, engineering data, and tests.
    c. Complete nomenclature and commercial number of replaceable parts.
    d. Model number and name plate data for each piece of equipment.
    e. Assembly drawings.

f. List of all special tools required to service equipment and/or systems including where the tools are stored.

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.
   e. Control settings and ranges.

3. Maintenance procedures:

   a. Type and frequency of preventive maintenance activities required for each piece of equipment.
   b. Guide to "trouble-shooting."
   c. Disassembly, repair, and re-assembly.
   d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule:

   a. List of lubricants required.
   b. Period between lubrications.

5. Manufacturer's printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line.)

6. Description of sequence of operation.

7. The 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.

8. As-installed control diagrams.

9. Each Contractor's coordination drawings.

10. List of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

11. Other data as required under pertinent sections of the Specifications.

12. Charts of equipment, instrument, and valve tag numbers with location and function:

    a. Reference drawing which shows equipment, instrument, or valve location.
    b. Manufacturer's model and serial number.
    c. Valve actuator type (manual, hydraulic, electric, or pneumatic).

13. Local services (process water and air, drains, HVAC, natural gas and steam).

C. The Contractor shall prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.

D. Additional requirements for O&M data required by other sections of the Specifications.

PART 2 PRODUCTS

2.01 O&M MANUALS

A. Electronic Version: O&M Manuals shall be provided electronically. The manual files must be in PDF format capable of being read, annotated, and printed with Adobe Standard, Adobe Pro, or BlueBeam, unless other software and file format is approved by the Owner, at the time of the transmittal of documents. AutoCAD files for drawings shall be provided separately from PDF versions included in the manual.

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02071
GEOMEMBRANE (HDPE)

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install a single 60-mil, textured, high-density polyethylene (HDPE) geomembrane as a component of the geomembrane liner system as shown on the Drawings and specified in this Section.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Manufacturer's Information

1. Manufacturer's Information shall be submitted within 10 days of the Notice to Proceed.

2. The Manufacturer's name, address, and primary contact.

3. The Manufacturing plant name and address where the geomembrane for this project will be produced.

4. The Manufacturer's qualifications including:

   a. A minimum of 5 years of successful development and production of geomembrane.
   b. Evidence of production of at least 10 million square feet of geomembrane that meets the specifications of Article 2.02.
   c. Certification that the Manufacturer has sufficient capacity to provide the required material in the given timeframe.
   d. A list of at least 10 projects for which geomembrane has been supplied by the Manufacturer, three of which shall have been for projects of similar size.

5. Product name and the Manufacturer's description of the proposed geomembrane and five representative samples of the product (small samples approximately 5 inches long by 4 inches wide enclosed in plastic labeled with product name) proposed for use on this project.

6. The Manufacturer's material properties sheet (cut sheet) of the proposed geomembrane documenting it will meet or exceed specified requirements.

7. The Manufacturer's quality control certificates for raw resin material. Testing must be done in accordance with the Manufacturer's Quality Control (MQC) plan with a minimum of one test per lot and include tests listed in the table in Paragraph 2.01C.

8. The Manufacturer's quality control certificates for finished geomembrane. Testing must be done in accordance with the Manufacturer's QA/QC plan on the actual material to be shipped and include tests and frequencies performed as listed in the table in Paragraph 2.02I.

9. Written instructions for storing, handling, installing, seaming, and repairing proposed geomembrane, including recommendations for loading, unloading, and handling equipment (model number or load capacity) must be included.

10. Sample product warranty that meets the requirements of Article 1.05 and Section 01780, Warranties and Bonds.

11. The Manufacturer's Quality Control (MQC) plan, including examples of MQC certification documents, name and address of the quality control testing laboratory, quality control laboratory certification, examples of retesting notification, and documentation.

B. Installer's Information

1. The Contractor shall submit the Installer's Information as part of the Pre-Qualification of Construction Bidders prior to Award described in Section 2 and at least 30 days before the geomembrane is scheduled to begin to be installed.

2. Installer's name, address, and primary contact.

3. The Geomembrane Installer shall have current Approved Installation Contractor (AIC) status issued by the International Association of Geosynthetic Installers.

4. Installer's qualifications including a list of at least three previous projects of similar size to this project, including project name, location, size and date of installation, and evidence of installing at least 1 million square feet of geomembrane.

5. The geomembrane installer shall be an approved installer by the geomembrane manufacturer.

6. The Installer must submit the following written information verifying qualifications:

    a. A list of projects for which similar geomembrane has been installed for at least five projects totaling a minimum of 2 million square feet over the past 5 years.
    b. The résumé of a Field Installation Supervisor who has directly supervised over 1 million square feet of installation.
    c. The résumé of a Master Seamer who has seamed a minimum of 500,000 linear feet of seam.
    d. The résumé of a CQC Representative who has conducted quality control on at least two projects with a total of at least 1 million square feet of geomembrane.
    e. If any of the Installer's personnel changes during the project, the Contractor shall submit to the Engineer résumés of the replacement personnel from the Installer before the new personnel may work on the project.

7. Construction Quality Control (CQC) Plan including but not limited to the following:

    a. Description of seaming equipment and techniques.
    b. Description of methods for repairing.
    c. Description of method for removing rejected materials.
    d. Proposed staffing.
    e. Proposed equipment.
    f. Complete set of forms to be used for recording installation CQC data, including but not limited to daily record documents.

8. A preliminary panel layout plan, including at a minimum:

    a. Panel layout.
    b. Panel identification numbers.
    c. Field seams.
    d. Installed square footage of the geomembrane.
    e. Details that do not conform to the construction drawings.

9. A complete set of forms to be used for record installation CQC data.

10. The geomembrane Installer's sample product warranty that the geomembrane installation is guaranteed in accordance with Section 01780, Warranties and Bonds, and Article 1.05.

C. Project-Specific Product Acceptance Testing

1. After the Engineer's review and approval of the Manufacturer's Information, representative samples of the geomembrane product intended for this project and manufactured at the same plant that will produce the product for this project shall be sent to the CQA Laboratory for Project-Specific Product Acceptance Testing as listed in Article 2.02.A.

2. The Engineer's acceptance of the geomembrane product proposed for use on this project will depend on the results of the Project-Specific Product Acceptance testing. Project-Specific Product Acceptance test results shall be submitted to the Engineer 21 days before the geomembrane material is shipped to the project site. The geomembrane shall not be shipped before review and acceptance of the project-specific Product Acceptance Test results.

3. Product samples shall be sent to the Product Acceptance Laboratory unless otherwise noted. The sample package should include a cover letter referencing the project location, engineer project number, Manufacturer, date of sampling, lot and roll number, and MQC test data documented for the particular production run from which the sample was taken. This submittal shall conform to the requirements of Section 01330, Submittals and Acceptance. A copy of the cover letter shall be sent to the Engineer.

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Austin, Texas 78733
(800) 880-8378

4. The Contractor shall bear the cost of all Project-Specific Product Acceptance Testing, including shipping samples to Product Acceptance Laboratory.

5. Geomembrane Samples: The Manufacturer shall package and ship two 3-foot-long by the width-of-roll-wide samples to the Product Acceptance Laboratory. The Manufacturer shall package the samples securely for shipping to prevent damage. The sampler shall mark the Manufacturer's roll identification number as well as the machine direction on the sample. The Contractor shall submit MQC data for the roll sampled with the test results.

6. Interface Direct Shear Strength Testing: The CQA Laboratory shall perform one interface direct shear strength test - four normal load conditions for the one test configuration - in accordance with ASTM D5321 on representative samples of geomembrane and geocomposite in the configuration provided below.

    a. Test Configuration 1—Textured Geomembrane versus Geocomposite: Geomembrane is clamped to the top of the box and lower geotextile of geocomposite clamped to the bottom of the box and upper components of geocomposite shall be allowed to slide along the geomembrane.
    b. Submit the geocomposite sample.
    c. Saturate for 1 hour under full load before shearing and shear under fully saturated (tap water) conditions.
    d. Normal loads: See Paragraph 2.02A.
    e. Shear rate: 0.04 inch/minute.
    f. Provide complete shear versus displacement length to at least 3 inches of displacement.
    g. Report peak (maximum) shear strength and post-peak shear strength measured at 3 inches of displacement for all four normal loads. Report the location of the failure (i.e., slip plane).
    h. Results shall meet the requirements of Table 2 in Article 2.02.A.

7. If the results of any test do not conform to the requirements of this Specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days. If the retest does not conform to the requirements of this Section, the product shall be rejected and the Contractor must submit Pre-Construction Submittals pertaining to the new product and perform Project-Specific Acceptance Tests for the new product.

D. Manufacturer's Quality Control (MQC)

1. The Manufacturer's Quality Control data shall be submitted at least 21 days before geomembrane shipment.

2. The Contractor shall submit the MQC test results to demonstrate that the geomembrane is in accordance with this Specification.

3. MQC sampling shall be in accordance with the test methods and minimum test frequencies provided in Article 2.02. If no sampling protocol is

specified in the test method, then the samples shall be taken evenly spaced across the entire roll width in accordance with ASTM D4354.

4. Certification reports shall be submitted by the Manufacturer on the Manufacturer's letterhead and signed by an authorized representative of the Manufacturer.

5. MQC data shall be submitted electronically in PDF and data format (.xls, .xlsx, .csv, .txt, .doc, .docx, .accdb, etc.) that the data can be readily copied.

6. Provide the following information with MQC test data:

    a. Project Name, Project Location, Manufacturer, Product Name.
    b. Roll and lot numbers and any additional production identification.
    c. Results of MQC tests, including a description of test methods used.

7. The Engineer will reject rolls for which quality control requirements are not met.

8. If the results of any test do not conform to the requirements of this Specification, the Contractor may elect to retest from the same roll of product. The Contractor shall notify the Engineer that a retest is planned. Retesting results shall be reported within 7 days. If the retest does not conform to the requirements of this Specification, the product shall be rejected and removed from the site.

E. Construction Quality Control (CQC)

1. The Contractor's CQC representative will be responsible for quality control in accordance with the submitted CQC Plan. During construction the Installer shall submit the following weekly:

    a. Material delivery report.

    b. Rejected material removal report.

    c. Soil subgrade acceptance.

    d. Records of daily installation logs, including but not limited to:

        (1) Deployment, including roll numbers placed.
        (2) Destructive sample testing.
        (3) Seaming.

(4) Non-destructive tests.
(5) Trial welds.
(6) Repairs.

e. Weekly installation log data shall be submitted electronically in PDF and data format (.xls, .xlsx, .csv, .txt, .doc, .docx, .accdb, etc.) that the data can be readily copied.

f. Records of daily personnel activity.

g. Meeting reports.

h. Updated Record Drawings.

F. Record Drawings: The Contractor shall prepare, maintain, and submit Record Drawings showing geomembrane installation indicating panel locations, seam locations, and roll numbers for each panel in accordance with the requirements of the Contract Documents. The Record Drawings shall be updated throughout the project and are subject to field review by the Engineer any time upon request. Record Drawings shall be in accordance with Article 1.09.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
2. ASTM D1004—Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
3. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
4. ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.
5. ASTM D1603—Standard Test Method for Carbon Black Content in Olefin Plastics.
6. ASTM D3895—Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry.
7. ASTM D4218—Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

8. ASTM D4437/D4437M—Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
9. ASTM D4833/D4833M—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
10. ASTM D5199—Standard Test Method for Measuring Nominal Thickness of Geosynthetics.
11. ASTM D5321/D5321M—Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear.
12. ASTM D5397—Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
13. ASTM D5596—Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
14. ASTM D5641/D5641M—Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.
15. ASTM D5721—Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
16. ASTM D5820—Standard Practice for Pressurized Air Channel Evaluation of Dual-Seamed Geomembranes.
17. ASTM D5885/D5885M—Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.
18. ASTM D5994/D5994M—Standard Test Method for Measuring Core Thickness of Textured Geomembranes.
19. ASTM D6392—Standard Test Method for Determining the Integrity of Non-Reinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
20. ASTM D6497/D6497M—Standard Guide for Mechanical Attachment of Geomembrane to Penetrations or Structures.
21. ASTM D6693/D6693M—Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes.
22. ASTM D7466/D7466M—Standard Test Method for Measuring Asperity Height of Textured Geomembranes.
23. ASTM E96/E96M—Standard Test Methods for Water Vapor Transmission of Materials.

B. Environmental Protection Agency (EPA)

1. EPA/600/R-93-182—Quality Assurance and Quality Control for Waste Containment Facilities.

C. Geosynthetics Research Institute (GRI) Standards

1. GM-10—The Stress Crack Resistance of HDPE Sheet.
2. GRI Test Method GM-13—Test Methods, Test Properties, and Testing Frequency for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes.
3. GRI Test Method GM-19—Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes.

1.04 QUALITY ASSURANCE

A. MQC and CQC are the responsibility of the Contractor and are performed by the Manufacturer and Installer to document that the material and installation are in accordance with this Specification. The Installer's CQC representative will be responsible for CQC in accordance with the submitted CQC Plan, which is independent of Construction Quality Assurance (CQA).

B. The Owner will engage and pay for the services of an Engineer and/or CQA Consultant. The Owner will engage and pay for the services of an independent CQA Laboratory for monitoring the quality and installation of the geomembrane. The Manufacturer, Installer, and Contractor must help the Engineer with product sampling for CQA testing by providing samples, personnel, and equipment as necessary.

1. CQA tests will be the measure of the acceptance of material. The Contractor will be responsible for the cost of retesting if the CQA tests fail. The retests will be paid by the Owner and reimbursed by the Contractor.
2. Samples of geomembrane: After review of the project-specific Product Acceptance Test results, the Engineer or representative may visit the manufacturing plant and/or select product rolls to be sampled by the Manufacturer. The Manufacturer will ship one 3-foot-long by the width-of-roll-wide sample for every 100,000 square feet of material to the Engineer's CQA Laboratory for CQA testing. The sample package shall include a cover letter referencing the project location, project number, Manufacturer, date of sampling, lot and roll number, and MQC test data documented for the particular production run from which the sample was taken. A copy of the cover letter shall be submitted to the Engineer.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds, and as specified in this Section.

B. The geomembrane Manufacturer's warranty, in writing, that the geomembrane material is guaranteed for 5 years on a pro rata basis from the date of Substantial Completion. This warranty shall apply to normal use and service in a reuse water bottom liner application under exposure to wastewater treatment plant effluent and weather well as other exposures that can be anticipated from the intended use.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Material delivery, storage, and handling shall be in accordance with documents as required in Article 1.02, Manufacturer's Information and Installer's Information.

C. The Contractor shall deliver materials to the site only after the CQA Consultant approves the required submittals.

D. The Contractor shall identify and separate damaged rolls from undamaged rolls and store damaged rolls at locations designated by the Engineer. Rolls without proper labeling that identify roll number and dimensions will be considered damaged. Damaged material will be repaired or rejected at the discretion of the CQA Consultant. The cost of repair or replacement will be borne by the Contractor.

E. The Contractor shall store geomembrane rolls in a location designated by the Engineer. In the absence of a specific location, material must not be stored in areas that will impair the operations of the facility or harm the materials.

F. The Contractor shall store geomembrane rolls to protect them from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.

G. The Contractor shall store geomembrane rolls on a prepared surface. Prevent water from accumulating beneath the rolls.

H. The Contractor shall not store geomembrane outdoors for more than 6 months. The geomembrane shall be moved inside an enclosed facility for storage exceeding 6 months. If an enclosed facility does not exist, a temporary enclosure shall be constructed.

I. The Contractor shall not stack geomembrane more than three rolls high.

J. The Contractor shall use appropriate handling equipment to unload and store geomembrane rolls. Appropriate equipment includes cloth chokers and spreader bars. The equipment must be of sufficient size and capacity to safely and efficiently handle geomembrane materials without damage to the materials or injury to personnel.

K. The Contractor shall not drag panels or rolls on the ground.

L. The Contractor shall not crease geomembrane material; creased material will be rejected.

M. Shipping materials including straps are the property of the Owner and will be set aside by the Contractor for the Owner's use.

1.07 QUALIFICATIONS

A. Provide the Manufacturer's and Installer's qualifications in accordance with Article 1.02.

1.08 TESTING REQUIREMENTS

A. Provide samples and testing for CQC testing in accordance with the requirements of this Section. Provide samples for CQA testing in accordance with the requirements of this Section. Please refer to the material requirement and testing frequencies provided in this Section.

B. CQA testing shall be performed for the material properties list in Part 2 of this Section. The cost of CQA testing shall be paid by the Owner.

C. If CQA tests fail the requirements of this Section, the retesting of material provided by the Contractor will be paid for by the Owner and the cost reimbursed by the Contractor as part of the project's final change order.

1.09 RECORD DRAWINGS

A. Geomembrane installation Record Drawings shall include complete CQC reports for the installation of primary, protective geomembranes. Reports shall be typed and provided in PDF format. The CQC reports shall include the following:

1. Completed soil subgrade acceptance forms.

2. Records of daily installation logs, including:

    a. Deployment, including roll numbers placed.
    b. Destructive sample testing.
    c. Seaming.
    d. Non-destructive tests.
    e. Trial welds.
    f. Repairs.

B. The Record Drawings shall include an as-built panel layout drawing for the installation of primary, secondary, and GCL protective geomembranes. The as-built panel layout drawings shall be submitted on a full-size drawing (22 × 34 inches or 24 × 36 inches) and shall be submitted in AutoCAD and PDF formats. The as-built panel layout drawing shall indicate the following at a minimum:

    1. Panel number.
    2. Geomembrane roll number.
    3. Anchor trench.
    4. Tie-in to existing liner.
    5. Repairs locations with unique identification number.
    6. Destructive sample locations with unique identification number.

1.10 DEFINITIONS

A. *Batch*: A quantity of resin, usually the capacity of one rail car, used in the fabrication of HDPE geomembrane sheet. A roll number corresponding to the particular quantity of resin used will identify the finished sheet.

B. *Bridging*: The condition when geomembrane becomes suspended over its subgrade due to contraction of the material or poor installation.

C. *Extrudate*: The molten polymer emitted from an extruder during seaming using either extrusion fillet or extrusion flat methods. The polymer is initially in the form of a ribbon rod, bead, or pellets.

D. *GCL Protective Geomembrane:* A geomembrane placed below the GCL in the leachate collection trenches and sumps to protect the GCL from groundwater hydration.

E. *Geomembrane*: An essentially impermeable membrane used as a solid or liquid barrier. Synonymous term for flexible membrane liner (FML).

F. *Geomembrane Manufacturer (Manufacturer)*: The party responsible for producing the geomembrane rolls from resin and for the quality of the resin.

G. *Geomembrane Subgrade*: The soil or geosynthetic surface on which the geomembrane lies.

H. *Installer*: The party responsible for field handling, transporting, storing, deploying, seaming, temporarily restraining (against wind), and installing the geomembrane.

I. *Lot*: A group of consecutively numbered rolls manufactured from the same resin batch or production line. For this Section, a lot may not exceed 180,000 pounds of raw resin material.

J. *Manufacturing Quality Assurance* (MQA): A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits, and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. *MQA* refers to measures taken by the MQA organization to determine if the Manufacturer complies with the product certification and contract specifications for the project.

K. *Manufacturing Quality Control* (MQC): A planned system of inspections that is used to directly monitor and control the manufacture of a material, which is factory originated. MQC is normally performed by the Manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the Manufacturer to determine compliance with the requirements of materials and workmanship as stated in certification documents and contract specifications.

L. *Panel*: The unit area of geomembrane that will be seamed in the field. If the geomembrane is not fabricated into panels in a factory, a panel is identified as a roll or portion of a roll without any seams.

PART 2 PRODUCTS

The Manufacturer shall supply the following products:

2.01 GEOMEMBRANE RESIN

A. The geomembrane resin shall be virgin materials with no more than 10% reworked material from the same formulation as the parent material.

B. Do not add any post-consumer resin (PCR) of any type to the formulation.

C. Use materials meeting the following requirements unless otherwise approved:

Table 1 Geomembrane Resin Test Requirements		
Test	Test Designation	Requirements
1. Melt Index	ASTM D1238	< 1.0g /10 min
2. Specific Gravity	ASTM D1505 or D792 Method B	> 0.932 g/mL

2.02 PROPERTIES FOR TEXTURED HIGH-DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE

The Manufacturer shall ensure that the textured HDPE Geomembrane has the following properties:

A. Project-Specific Product Acceptance Test Requirements:

Table 2 Project-Specific Product Acceptance Test Requirements				
Test	ASTM Test Designation	Minimum Test Frequency	Required Test Values	
			Required Peak Shear Strength (psf)	Normal Load (psf)
Interface Shear Strength (see Paragraph 1.02C.6 for test configurations)	D5321	1 per project	50	250
			200	1,000
			1,560	8,000
			2,925	15,000

B. Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and defects that would affect the specified properties of the geomembrane (GRI GM-13).

C. The geomembrane may not exceed a combined maximum total of 1% by weight of additives other than carbon black or pigment.

D. The geomembrane may not exceed 3.5% by weight of finished geomembrane for total combined processing aids, antioxidants, carbon black, and other additives.

E. All additives for UV protection, thermal stability, color, or processing agents must not "bloom" to the surface over time or inhibit welding.

F. The finished product must be free from blemishes, holes, pin holes, bubbles, blisters, excessive gels, undispersed resins and/or carbon black, contamination by foreign matter, as well as nicks or cuts on edges. The Manufacturer shall continuously perform spark tests during manufacturing to locate holes in the geomembrane. Repair holes before shipping in accordance with Article 3.22.

G. White co-extruded geomembrane may be used in place of black HDPE geomembrane.

H. Roll manufactured sheets for shipment.

I. The geomembrane must conform to the following requirements in general accordance with GRI GM-13 (some requirements are stricter than GM-13):

Table 3 Geomembrane Test Requirements

Test	Test Designation	MQC Test Frequency	Requirements
1. Sheet Thickness	ASTM D5994	Per roll	60 mils minus 15% for any measurement, minus 10% for 8 out of 10 individual values, and the average of all measurements for any roll, not less than 37 mils
2. Asperity Height *(1)*	ASTM D7466	Every second roll *(1)*	16 mils and as needed to meet shear-strength requirements
3. Sheet density	ASTM D1505 (preferred) or D792 Method B	1/50,000 sf	> 0.940 g/cc
4. Tensile Properties *(2)*			
a. Yield Strength	ASTM D6693 Type IV	1/50,000 sf	> 126 lb/in
b. Break Strength	ASTM D6693 Type IV	1/50,000 sf	> 90 lb/in
c. Yield Elongation	ASTM D6693, Type IV	1/50,000 sf	> 12% each sample
d. Break Elongation	ASTM D6693, Type IV	1/50,000 sf	> 100%
5. Tear Resistance	ASTM D1004, Die C	1/100,000 sf	> 42 lb
6. Puncture Resistance	ASTM D4833	1/100,000 sf	> 90 lb
7. Stress Crack Resistance *(3)*	ASTM D5397 (App.)	Per GRI GM10	> 500 hr
8. Carbon Black Content	ASTM D4218 *(4)*	1/50,000 sf	2.0 to 3.0%
9. Carbon Black Dispersion	ASTM D5596	1/100,000 sf	*(5)*

Table 3 Geomembrane Test Requirements			
Test	Test Designation	MQC Test Frequency	Requirements
10. Standard Oxidation Induction Time of Polyolefins *(6)*	ASTM D3895 or ASTM D5885	One per formulation	Minimum average 100 minutes or Minimum average 400 minutes
11. Oven Aging at 85°C *(6), (7)*	D 5721	Per each formulation	
a. Standard OIT (min. ave.) – % retained after 90 days	D 3895		55
— or —			
b. High Pressure OIT (min. ave.) – % retained after 90 days	D 5885		80
12. UV Resistance *(8)*	D 7238	Per each formulation	
a. High Pressure OIT (min. ave.) – % retained after 1,600 hrs *(9)*	D 5885		50

Notes:
(1) Alternate the measurement side for double-sided textured sheet.
(2) Machine direction (MD) and cross-machine direction (XMD) average values should be on the basis of five test specimens each direction. Yield elongation is calculated using a gauge length of 1.3 inches. Break elongation is calculated using a gauge length of 2.0 inches.
(3) SP-NCTL in accordance with ASTM D5397 Appendix, is not appropriate for testing geomembranes with textured or irregular rough surfaces. The test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials. The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(4) Other methods such as ASTM D1603 (tube furnace) or D6370 (TGA) are acceptable if an appropriate correlation to D4218 (muffle furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: Nine in Categories 1 or 2 and one in Category 3.
(6) The manufacturer has the option to select one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) Evaluating samples at 30 and 60 days to compare with the 90-day response is also recommended.
(8) The condition of the test should be 20 hours. Ultraviolent (UV) cycle at 75°C followed by 4-hour condensation at 60°C.
(9) UV resistance is based on percent-retained value regardless of the original HP-OIT value.

2.03 MANUFACTURER SOURCE QUALITY CONTROL (MQC) TESTING

A. The Manufacturer shall perform the Manufacturer's quality control tests listed above.

B. Submit as indicated in Part 1 of this Section.

2.04 EXTRUDATE ROD OR BEAD

A. Made from same resin type as the geomembrane.

B. Containing 2% to 3% carbon black.

PART 3 EXECUTION (INSTALLER)

3.01 CERTIFICATION OF GEOMEMBRANE SUBGRADE

A. The Installer shall verify in writing by submitting a subgrade acceptance form to the CQA Consultant that the surface on which the geomembrane will be installed is acceptable.

B. The Installer shall verify that no particles project from the underlying surface that could puncture or damage the geomembrane.

3.02 PREPARATION

A. The Contractor shall repair any damage to the subgrade (soil or GCL) before deploying the geomembrane.

B. Round edges of anchor trenches or cushion with geotextiles.

3.03 TRIAL SEAM WELDS

The Contractor shall perform trial seam welds as follows:

A. Perform trial welds on samples of geomembrane to verify the performance of welding equipment, welding personnel, seam welding methods, and weather conditions.

B. Do not begin production seam welding until equipment and welders have successfully completed trial welds.

C. Frequency of trial welds:

1. There shall be a minimum of two trial welds per day per equipment and per seamer with one before the start of work and one at mid shift.
2. After any equipment shutdown or loss of power.
3. When directed by the CQA Monitor.

D. Make trial welds in the same surroundings and environmental conditions as the production welds (i.e., in contact with subgrade or GCL).

E. Make trial weld sample at least 6 feet long for dual-hot-wedge welding machines and 6 feet long for extrusion welds.

F. Allow welds to cool for 5 minutes and then cut excess material from the ends of the welds.

G. Using a cutting die cut ten 1-inch specimens spaced evenly along the length of the weld.

H. Using a field tensiometer, test specimens for peel adhesion and bonded seam strength (ASTM D6392). Test both sides of the weld for peel strength (fusion welds only). Test at a separation rate of 2 inches per minute.

I. A weld is considered passing when the following results are achieved in accordance with GRI GM-19 Table 1(a):

1. The break is a film-tearing bond (FTB). The following are unacceptable break codes according to their description in ASTM D6392 (in this regard, SIP is an acceptable break code):

    a. Hot Wedge: AD and AD-Brk > 25%.
    b. Extrusion Fillet: AD1, AD2.
    c. Exception: AD-WLD (unless strength is achieved).

2. The peel strength is a minimum of 91 pounds per inch for 60-mil thick at yield for wedge welds or flat welds and a minimum of 78 pounds per inch for 60-mil thick at yield for extrusion welds. The peel separation (or incursion) shall not exceed 25%.

3. There is no more than 25% separation of the weld. For wedge welds the width of the weld is considered the width of the nip roller.

4. The shear strength is a minimum of 120 pounds per inch for all weld types. Set grips back 2 inches from the edge of the weld when testing. Minimum elongation between the grips must be 2 inches. The shear elongation at break shall exceed 50% (shear elongation testing shall be omitted during field testing but included in laboratory tests.)

5. The test is acceptable when all test specimens pass the peel and shear tests.

J. Repeat the trial weld in its entirety when any of the trial weld specimens fail in either peel or shear.

K. When repeated trial weld fails, do not use the welding apparatus and welder until deficiencies or conditions are corrected and two consecutive successful trial welds are achieved.

3.04 DEPLOYMENT

A. Carefully consider the timing and temperature during deployment. Focus on verifying that there are no bridging or stresses in the geomembrane and there are no wrinkles in the geomembrane.

B. Deployment, welding, and covering would all occur at the same temperature. In a practical sense, strive to perform these activities within as narrow a temperature range as practical and avoid these activities during peak hot or cold conditions.

C. Deploy manually or by use of spreader bar attached to equipment as approved by the Manufacturer. The equipment shall not damage the subgrade, GCL, geomembrane, or other geosynthetic materials.

D. Provide minimum overlap of 4 inches (for extrusion welding) or 6 inches (for fusion welding) between panels.

E. Dual-hot-wedge welding is the preferred method of seaming. Extrusion welding shall be limited to areas that cannot be fusion welded (i.e., patches).

F. Panel Identification: Assign each panel an identifying code number or letter consistent with the approved panel layout drawing. The coding is subject to approval by the CQA Monitor.

G. Repair damage to subgrade or other underlying materials before completing deployment of geomembrane.

H. Do not deploy more panels in one shift than can be welded or secured during that same shift.

I. Do not deploy in the presence of excessive moisture, precipitation, ponded water, or high winds.

J. Do not damage the geomembrane when handling, with equipment traffic, due to leakage of hydrocarbons, or by any other means.

K. Do not wear shoes that can damage the geomembrane.

L. Unroll geomembrane panels using methods that will not damage, stretch, or crimp the geomembrane. Protect the underlying surface from damage.

M. Place ballast on the geomembrane that will prevent wind from uplifting and moving the geomembrane.

N. Use ballast that will not damage the geomembrane.

O. Protect the geomembrane in areas of heavy traffic by placing a protective cover over the geomembrane.

P. Do not allow any vehicular traffic directly on the geomembrane without approval from the Engineer.

Q. Remove wrinkled or creased material.

R. Install material to account for shrinkage and contraction while avoiding wrinkles. Install material stress-free with no bridging before it is covered. Add material as needed to avoid bridging.

S. Before wrinkles fold over, attempt to push them out. For wrinkles that cannot be pushed out, cut them out and repair.

T. Do not allow textured surfaces to be dragged over the installed geocomposite. Use a smooth geosynthetic slip sheet or rub sheet as necessary to reduce friction damage during deployment.

U. Visually inspect geomembrane for imperfections. Mark faulty or suspect areas for repair.

3.05 SEAM LAYOUT

A. Orient seams parallel to the line of a maximum slope, i.e., orient down, not across a slope.

B. Minimize the number of field seams in corners, odd-shaped geometric locations, and outside corners.

C. Keep horizontal seams (seams running approximately parallel to slope contours) at least 6 feet away from the toe or crest of slope.

D. When full-roll lengths do not extend past the toe of slope, panel ends may be seamed provided the panel is cut at an angle greater than 45º. The use of 45º seams along the slope is limited to situations that are unavoidable due to slope geometry.

E. Use a seam-numbering system compatible with the panel number system.

F. Shingle panels on all slopes and grades to promote drainage over the seam, not into the seam.

3.06 WELDING EQUIPMENT

A. The Contractor shall maintain sufficient operating seaming apparatus to continue work without delay.

B. Use a power source capable of providing constant voltage under combined line load.

C. Provide protective lining and splash pad large enough to catch spilled fuel under the electric generator if the generator is positioned on the geomembrane.

D. Provide extrusion welders equipped with gauges showing temperatures in the extruder apparatus and at the nozzle.

E. Provide a hot-wedge welder meeting the following requirements:

1. Contained on wheeled chassis and self-propelled.
2. Automated variable-speed capability.
3. Equipped with devices for adjusting temperatures at the wedge.
4. Pressure controlled by springs, pneumatics, or other system that allows for variation in sheet thickness.

F. Rigid-frame fixed-position equipment is not acceptable.

3.07 TEST EQUIPMENT

A. The Contractor shall provide a tensiometer capable of measuring seam strength. The tensiometer must be calibrated and accurate within 2 pounds. The Contractor shall provide calibration certification within the last 12 months for inspection upon request by the Engineer.

B. The Contractor shall provide non-destructive testing equipment (i.e., vacuum box) (ASTM D4437/D4437M).

C. The Contractor shall provide dies for cutting seam samples.

3.08 GENERAL WELDING PROCEDURES

A. Do not begin welding until the welder and equipment pass the trial weld tests.

B. Clean seam area surfaces of grease, moisture, dust, dirt, debris, or other foreign material.

C. Overlap panels a minimum of 4 inches for extrusion and 6 inches for hot-wedge welding.

D. Construct the weld with adequate material width on each side of the weld to allow peel and shear testing.

E. Extend welding to the outside edge of all panels.

F. If required for firm support, provide a firm subgrade under the seaming area.

G. Cut fish mouths or wrinkles along the ridge of the wrinkle to achieve a flap overlap. Extrusion-weld the cut fish mouths or wrinkles where the overlap is more than 3 inches. When there is less than a 3-inch overlap, patch with an oval or round patch extending a minimum of 6 inches in all directions beyond the cut.

3.09 EXTRUSION TYPE OF WELDING

A. The Contractor shall use procedures to tack bond adjacent panels together that do not damage geomembrane and allow CQA tests to be performed.

B. Purge welding apparatus of heat-degraded extrudate before welding.

C. Bevel top edges of geomembrane a minimum of 45° and the full thickness of the geomembrane before extrusion welding.

D. Clean seam-welding surfaces of oxidation by disc grinder or equivalent not more than 30 minutes before extrusion welding. Change grinding discs frequently. Do not use clogged discs.

E. Do not remove more than 4 mils of material when grinding.

F. Grind across, not parallel to, welds.

G. Cover entire width of grind area with extrudate.

H. When restarting welding, grind ends of all welds that are more than 5 minutes old.

3.10 HOT WEDGE WELDING

A. Place smooth insulating plate or fabric beneath hot welding apparatus after use.

B. Protect against moisture build-up between panels.

C. If welding cross seams, conduct field test welds at least every 2 hours; otherwise, conduct tests once before the start of work and once at mid-day.

D. Bevel edges of top and bottom panels on cross seams.

E. Extrusion-weld a repair patch over all tee and cross-seam intersections.

3.11 INSTALLATION QUALITY CONTROL

A. Log the following every 4 hours:

1. Temperature 6 inches above the geomembrane surface being welded.
2. Extrudate temperatures in barrel and at nozzle (extrusion welder).
3. Operating temperature of hot wedge (hot-wedge welder) and any pressure adjustments made.
4. Preheat temperature.
5. Speed of hot wedge welder in feet per minute.

B. Weld only when ambient temperature measured 6 inches above the geomembrane is between 40°F and 130°F.

C. If seaming at ambient temperatures below 40°F (5°C) or above 130°F (40°C), the Contractor shall demonstrate and certify that such methods produce seams which are entirely equivalent to seams produced at ambient temperatures above 40°F (5°C) and below 130°F (40°C). Certify that the overall quality of the geomembrane is not adversely affected. Perform work under a contract change order that states the seaming procedure will not cause any physical or chemical modification to the geomembrane which will generate short- or long-term damage to the geomembrane.

D. Seaming below temperatures of 32°F must be performed under cold weather welding procedures approved by the Engineer.

3.12 NON-DESTRUCTIVE TESTING

A. The Contractor shall non-destructively test all field seams over their full length using a vacuum test unit, air pressure (for dual-hot-wedge seams only), spark testing, or other approved methods (ASTM D4437/D4437M).

B. Perform testing as the seaming progresses and not at the completion of all the field seaming.

C. Note all required repairs in CQC reports and then complete all required repairs in accordance with this Specification.

3.13 NON-DESTRUCTIVE VACUUM TESTING

A. Equipment

1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom porthole or valve assembly, and a vacuum gauge.
2. A vacuum pump assembly equipped with a pressure control.
3. A rubber pressure/vacuum hose with fittings and connections.
4. A soapy solution and an applicator.

B. Vacuum Box Test Procedures

1. Wet the seam area with a soapy solution.
2. Place the box over the wetted seam area. Ensure that a leak-tight seal is created.
3. Energize the vacuum pump.
4. Reduce the vacuum box pressure to approximately 10 inches of mercury (i.e., 5-psi gauge).
5. Examine the geomembrane through the viewing window for the presence of soap bubbles for not less than 10 seconds.
6. Mark areas where soap bubbles appear.
7. Repair in accordance with repair procedures described in this Specification.

3.14 NON-DESTRUCTIVE AIR PRESSURE TESTING FOR DUAL-HOT-WEDGE WELD

A. Equipment

1. An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure over 70 psi and mounted on a cushion to protect the geomembrane.
2. A rubber hose with fittings and connections.
3. A sharp hollow needle or other approved pressure-feed device.
4. A pressure gauge with an accuracy of plus or minus 1 psi.

B. Test Procedures

1. Seal both ends of the welded seam to be tested.
2. Insert needle or other approved pressure-feed device into the tunnel created by the weld.
3. Energize the air pump to a minimum pressure of 30 psi.
4. Maintain this pressure for 5 minutes.
5. Close the valve allowing 5 minutes relaxation time. During the relaxation time the air pressure cannot drop more than 2 psi.
6. If loss of pressure exceeds 2 psi or does not stabilize, the Contractor shall locate the faulty area and repair it in accordance with repair procedures described in this Specification.
7. Puncture the opposite end of the seam to release air. If blockage is present, locate and test the seam on both sides of the blockage.
8. Remove the needle or other approved pressure-feed device.
9. Repair the penetration holes.

3.15 SPARK TEST PENETRATIONS OR OTHER DIFFICULT AREAS AS AN ALTERNATIVE TO VACUUM TESTING

A. Equipment and Materials

1. 24-gauge copper wire.
2. Low-amperage electric detector, 20,000 to 30,000 volt, with brush-type electrode capable of causing visible arc up to 3/4 inch from copper wire.

B. Spark Testing Procedures

1. During extrusion welding, place a copper wire within 1/4 inch of the edge of the extrusion weld.
2. Pass an electrode over the seam area and observe for spark. If a spark is detected, perform a repair.

3.16 LABORATORY DESTRUCTIVE TESTING

A. Location and Frequency of Testing

1. Collect destructive test samples at a minimum frequency of one test location per 500 feet of seam length.
2. Determine test locations during welding. Locations may be prompted by suspicion or excess crystallinity, contamination, offset welds, or suspected defect. The CQA Monitor will be responsible for choosing the locations. The CQA Monitor will not notify the Installer in advance of selecting locations where weld samples will be taken.

3. The CQA Monitor may increase the test frequency based on marginal results.

B. Sampling Procedures

1. The Installer shall cut samples at locations designated by the CQA Monitor as the welding progresses. The Installer is to verify that passing laboratory test results have been obtained before the geomembrane is covered by another material.
2. The CQA Monitor will number each sample and mark the sample number and location in compliance with the CQA program.

C. The Contractor shall immediately repair all holes in the geomembrane resulting from destructive test sampling in accordance with repair procedures described in this Section. Test the continuity of the repair in accordance with this Section.

D. Size of Samples: Samples shall be a minimum of 12 inches wide by 52 inches long with the seam centered lengthwise. Cut ten 1-inch-wide strips evenly across the sample and test these for (shear and peel) in the field. Cut the remaining sample into three parts for distribution as follows:

1. One portion for the Installer: 12 inches by 12 inches.
2. One portion for the CQA Laboratory: 12 inches by 18 inches.
3. One portion to the Engineer for archive storage: minimum 12 inches by 12 inches.

3.17 FIELD TESTING (PERFORMED BY INSTALLER)

A. Test the ten 1-inch-wide strips specified in Paragraph 3.03.H above by tensiometer for peel and shear.

B. The test strips must meet peel and shear requirements for welded seams specified in Paragraph 3.02.I.

C. If any field test sample fails, follow failed test procedures outlined in this Section.

3.18 LABORATORY TESTING PERFORMED INDEPENDENTLY BY CONSTRUCTION QUALITY ASSURANCE (CQA) LABORATORY

A. The Engineer will retain an independent CQA Laboratory to perform CQA testing.

B. Test "seam strength" and "peel adhesion" (ASTM D6392).

C. Test at least five specimens for each test method. Minimum acceptable values to be obtained for these tests are specified in Paragraph 3.02I.

D. Select specimens alternately by test from the samples (i.e., peel, shear, peel, shear).

E. Provide test results no more than 48 hours after receiving samples.

F. For dual-hot-wedge welded samples, test both sides in peel.

G. Seams failing testing and/or inspection shall be repaired, reinspected, and retested by the Owner until compliance is attained. However, the Contractor shall reimburse the Owner for all failed tests.

3.19 FAILED WELD PROCEDURES

A. The Installer shall follow one of the following options when there is a destructive test failure:

1. First Option:

a. Reconstruct the seam between any two passing test locations. Do not extrusion weld the flap.

2. Second Option:

a. Trace the weld at least 10 feet minimum in both directions along the seam from the failed specimen.
b. Obtain specimens at these locations for additional field tests. Obtain specimens as described above.
c. If the additional test specimens meet seam quality requirements, repair the seam between the passing seam specimen locations or the passing specimen location and the end of the seam.
d. If any specimen fails to meet seam quality requirements, repeat the process to establish the zone in which the seam must be repaired.

B. Shear or peel test: If a shear or peel test taken from a butt seam fails, cap the entire butt seam. Obtain a specimen from the cap and perform a shear and peel test. If the test from the cap specimen fails, repeat the capping until a passing test is obtained from a specimen of the cap weld.

C. Whenever a sample fails, perform additional trial seams for the specific welder and welding apparatus.

3.20 ACCEPTABLE WELDED SEAMS

Welded seams are considered acceptable under the following conditions:

A. The weld passes all non-destructive tests and the weld is bracketed by two locations from which all specimens have passed destructive tests.

B. For reconstructed seams exceeding 50 feet, a specimen taken from within the reconstructed weld passes destructive testing and all non-destructive tests pass.

3.21 SEAMS THAT CANNOT BE DESTRUCTIVELY TESTED

A. If the weld cannot be tested, cap strip the weld. The welding and cap-stripping operations must be observed by the CQA Monitor and Installer for uniformity and completeness. The cap strip must pass nondestructive testing.

3.22 DEFECT AND REPAIR PROCEDURES

A. The repair procedures, materials, and techniques must be accepted in advance of the specific repair by the Owner, the Engineer, and the Installer.

B. The Contractor shall examine all welds and non-weld areas of the geomembrane for defects, holes, blister, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane must be clean at the time of the examination.

C. Repair and non-destructively test each suspect location regardless if it is in a weld area or discovered in the panel. Do not cover geomembrane at locations that have been repaired until test results with passing values are available.

D. Extrusion weld a patch over all “cross” or “tee” welds and specimen locations.

E. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

F. Repair, removal, and replacement are at the Contractor's expense if the damage results from the Contractor's, Installer's, or the Contractor's subcontractor’s activities.

G. Repair any portion of the geomembrane exhibiting a flaw or failing a destructive or non-destructive test. The Owner, the Engineer, the Installer must agree on the appropriate repair method. Acceptable repair procedures may include:

1. Patching: Used to repair large holes (over 3/8-inch diameter), tears (over 2 inches long), undispersed raw materials, and contamination by foreign matter and to cover cross and tee connections.
2. Abrading and re-welding: Used to repair small sections of seams.
3. Spot welding or seaming: Used to repair small tears (less than 2 inches long), pinholes, or other minor localized flaws.
4. Capping: Used to repair large lengths (greater than 2 inches long) of failed seams.
5. Complete replacement of the seam.

H. In addition, the Contractor must do the following:

1. Abrade geomembrane surfaces to be repaired (extrusion welds only) no more than 1 hour before the repair.
2. Clean and dry all surfaces at the time of repair.
3. Extend patches or caps at least 6 inches beyond the edge of the defect and round all corners of material to be patched and the patches to a radius of at least 3 inches.
4. Unless otherwise instructed by the Engineer, cut geomembrane below large caps to avoid water or gas collection between the sheets.

I. Verification of Repair

1. Number and log each repair.
2. Non-destructively test each repair using methods specified in this Section.
3. Destructive tests may be required at the discretion of the Engineer.
4. Reconstruct repairs until tests indicate passing results.

3.23 GEOMEMBRANE ACCEPTANCE

A. The Contractor retains all Ownership and responsibility for the geomembrane until acceptance by the Engineer.

B. The Engineer will accept geomembrane installation when:

1. All required MQC and Installer records have been received and accepted.
2. The installation is finished.
3. Test reports verifying completion of all field seams and repairs, including associated testing, have been received.

4. Written certification documents and drawings have been received by the Engineer.

END OF SECTION

SECTION 02230
SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required and perform all site preparation, complete as shown on the Drawings and as specified in this Section.

B. The Contractor shall obtain all permits required for site preparation before proceeding with the work, including clearing and tree removal.

C. The areas to be cleared, grubbed, and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of pipeline work and in consideration of the actual means and methods of construction used. No unnecessary site preparation shall be performed within these areas.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

A. Submit to the Engineer copies of all permits required before clearing, grubbing, and stripping work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

A. The Contractor shall cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and any other objectionable material resting on or protruding through the surface of the ground which is not indicated to be protected in the Contract Documents. The Contractor shall coordinate with the Owner to ensure tree removal is authorized by Columbia County's appropriate Land Development Regulation Administrator before removing trees.

B. The Contractor shall preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer to remain as specified below.

3.02 GRUBBING

A. The Contractor shall grub and remove all stumps, roots in excess of 1-1/2 inches in diameter, matted roots, brush, timber, logs, concrete rubble, and other debris encountered to a depth of 18 inches below original grade or 18 inches beneath the bottom of foundations, whichever is deeper.

B. The Contractor shall refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density conforming to the surrounding ground surface in accordance with Section 02300, Earthwork for Structures, and Section 02305, Earthwork for Utilities.

3.03 STRIPPING

A. The Contractor shall strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.

B. Topsoil shall be free from brush, trash, large stones, and other extraneous material. Avoid mixing topsoil with subsoil.

C. The Contractor shall stockpile and protect topsoil until it is used in landscaping, loaming, and seeding operations and dispose of surplus topsoil after all work is completed.

3.04 DISPOSAL

A. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area. No rubbish or debris of any kind shall be buried on the site.

B. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

3.05 PROTECTION

A. Trees and other vegetation designated on the Drawings or directed by the Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. The Contractor shall conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed. The Contractor shall provide for the safety of employees and others.

B. The Contractor shall maintain protection until all work in the vicinity of the work being protected has been completed.

C. The Contractor shall not operate heavy equipment or stockpile materials within the branch spread of existing trees.

D. The Contractor shall immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.

E. When work is completed the Contractor shall remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1 inch in diameter shall be treated with an acceptable tree wound paint.

F. The Contractor shall restrict construction activities to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements on these properties, public or private, which become damaged by construction operations shall be promptly restored to their original condition to the full satisfaction of the property owner.

G. The Contractor shall remove trees damaged beyond saving, through no fault of the Contractor, as directed by the Engineer.

END OF SECTION

SECTION 02240
DEWATERING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers the work necessary to complete the dewatering activities. All work in this Section shall be done in accordance with the requirements of the Environmental Resource Permit and Water Use Permit (if required) as issued by the Suwannee River Water Management District.

B. In addition to the requirements listed in this Section, the Contractor shall obtain, if required, and comply with all requirements of the Generic Permit for the Discharge of Ground Water From Any Non-Contaminated Site Activity as described in FAC 62-621-300, if applicable.

C. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Remove dewatering system if no longer needed.

D. The Contractor shall dewater so as to prevent damage to existing work. The Contractor shall repair or replace damage resulting from the dewatering activities promptly, remedy environmental damage as approved by the Engineer, and pay any and all fines levied to Contractor at no additional cost or time to the Owner.

E. The Contractor shall be responsible for preparing a Dewatering Plan. The Dewatering Plan shall be signed and sealed by the licensed professional engineer responsible for its preparation.

F. The Contractor shall design the dewatering system. The Contractor shall be responsible for obtaining whatever investigations are necessary, before bidding, to design the dewatering system.

1.02 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

A. Before construction, the Contractor shall obtain a dewatering permit from the Suwannee River Water Management District, as required. At a minimum, the dewatering plan submitted with the dewatering application shall include the following:

1. Duration of dewatering for each area.
2. Number and size of pumps.
3. Method of dewatering each area.
4. Methods for routing/containing the discharge.
5. Methods of isolating dewatering areas.
6. Time dewatering structure will be in place.
7. Proposed discharge points.

Electronic copies of the plan shall be submitted to the Engineer for record purposes only. Physical copies, the quantity to be determined by Owner, shall be provided if requested by the Engineer or Owner.

B. The Contractor shall be responsible for determining if a Water Use Permit will be required. If a Water Use Permit is required, it is the Contractor's responsibility to obtain the required information from the Engineer and Owner to complete the Water Use Permit application to submit with the Dewatering Plan. If a Water Use Permit is required, the Contractor shall submit electronic copies of the application to the Owner/Engineer for submittal purposes only. Physical copies, the quantity to be determined by the Owner, shall be provided if requested by the Engineer or Owner.

C. The Contractor shall be responsible for obtaining a Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity as set forth in FDEP Rule 62-621.300(2), FAC. The Contractor shall obtain the required permit Form 62-621.300(2) and the required information from the Engineer and Owner to complete the Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity application to submit with the Dewatering Plan. The Contractor shall submit electronic copies of the application to the Owner/Engineer for submittal purposes only. Physical copies, the quantity to be determined by the Owner, shall be provided if requested by the Engineer or Owner.

D. Provide photographs or videotape, sufficiently detailed, of existing conditions of adjoining properties, facilities, and other construction and site improvements that might be later misconstrued as damage caused by dewatering operations.

E. Submit Record Drawings at Project closeout identifying and locating utilities and other subsurface structural, electrical, or mechanical items encountered during dewatering.

1. Note locations and capping depth of wells and well points.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Administrative Code (FAC)

1. FAC 62-621-300—FDEP – Generic Permits.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

B. Pre-installation Conference: Conduct conference at the Project site to present and discuss dewatering means, methods, and monitoring program.

C. Identify a person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed for this Project, the referenced standards, environmental and permit requirements, the requirements of this Work, and who shall direct all work performed under this Section.

D. It shall be the responsibility of the Contractor to determine the water levels before and during the dewatering work.

1.05 PRE-BID INSPECTION AND TESTING

A. The Contractor is advised that site soil borings may indicate groundwater levels below the levels which may occur in response to normal, seasonal, extreme, or prolonged rainfall. The Contractor is further advised that site soil borings may not

necessarily represent soil conditions to be encountered elsewhere on the job site, other than at the specific boring locations.

B. Before bidding, the Contractor shall perform a detailed site inspection and, if desired, obtain the Owner's permission to perform site-specific testing as he deems necessary to obtain all required information relative to project dewatering requirements.

C. The Contractor shall include as part of his Bid the total cost of all surface and subsurface dewatering as required to construct the Project in complete compliance with the Drawings and these Specifications.

1.06 PROJECT CONDITIONS

A. The Contractor shall not interrupt utilities serving facilities occupied by Owner or others unless approved by the Owner and Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

B. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. The Owner will not be responsible for interpretations or conclusions drawn from these data.

1. The geotechnical report is included in an Appendix to these Specifications.
2. Make additional test borings and conduct other exploratory operations necessary for dewatering.

C. Survey adjacent structures and improvements, employing a professional land surveyor licensed in Florida to establish exact elevations at fixed points to monitor settlement. Clearly identify monitoring points and reference vertical datum, and benchmarks. Monitor and record existing initial elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction and existing structures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DEWATERING SYSTEM

A. The dewatering system shall be adequate to drain the soils to be excavated to the extent that the piezometric water level in the construction area is a minimum of 2 feet below the bottom of the excavation, side slopes of excavations, or bottom of the footings at all times, or as otherwise required to obtain the specified compaction and installation conditions. Pipeline trenches must be dewatered at least 1 foot below the trench bottom.

B. If layered soils are encountered, the hydrostatic head in the zone below the subgrade elevation shall be relieved to prevent uplift.

C. Unless otherwise noted and before any excavating below or within 2 feet above the groundwater level, a dewatering system shall be placed into operation to lower water levels to the extent specified previously and then shall be operated continuously 24 hours a day, 7 days a week, throughout the excavation to maintain and protect all work until the work has been completed to the satisfaction of the Engineer.

D. Where used, well points shall be installed in an Engineer-approved manner and in sufficient numbers to provide the necessary removal of water as stated previously. Well points and header piping shall be installed so that traffic on public thoroughfares and site access roads will not be impeded.

E. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the specified work. The dewatering system shall stay in full operation until not less than 90% of the total building load is applied, as will be determined by the Engineer, or until excavations and trenches have been backfilled and compacted.

F. To prevent excessive noise, exhaust from all pumps and engines shall be silenced and muffled.

G. Wellpoint or surface water pump discharge shall be controlled to prevent erosion, undermining, and all other damage and be piped to approved locations.

H. With the Engineer's assistance, the Contractor is responsible for determining what approvals and permits are required to comply with any and all applicable regulations and permitting requirements relating to dewatering activities. With the Engineer's assistance the Contractor shall obtain all necessary approvals and permits and comply with any and all applicable regulations and permitting requirements concerning all dewatering activities, including pumpage and

discharge. The Contractor is solely responsible for all costs associated with the proper implementation of dewatering activities.

I. The Contractor shall perform all dewatering work in strict compliance with Section 01350, Environmental Protection Procedures, and the Contract Drawings.

J. Excavations shall be kept free from water during the placing of concrete and for 36 hours after or until concrete forms are removed.

K. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or groundwater from entering excavations, ponding on prepared subgrades, or flooding the site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

L. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

M. Install sufficient dewatering equipment to drain water-bearing strata above and below the bottom of foundations. If excavating through layered soils, relieve any potential groundwater hydrostatic head in the zones below to prevent uplift.

1. Open-sump pumping which leads to loss of fines, subgrade softening, and slope instability shall not be permitted.

N. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids flooding or accumulation on private property. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

3.02 OBSERVATION WELLS

A. The Contractor shall install observation wells, as may be required, to record accurate water levels.

B. The Contractor shall be responsible for maintaining all observation wells and observing and recording the elevation of the piezometric water levels daily.

C. Wells damaged or destroyed shall be replaced at no additional cost to the Owner.

3.03 CLEANUP

A. Upon completing dewatering elsewhere on the Project, the Contractor shall remove all equipment and leave the project site in a neat, clean, and acceptable condition satisfactory to the Owner. Wellpoint holes and excavations shall be adequately backfilled and compacted to prevent settlement.

END OF SECTION

SECTION 02300
EARTHWORK FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment, tools, appliances, and materials and perform all operations necessary for the following:

1. Preparing subgrades for slab-on-grade, walks, pavements, and lawns and grasses.
2. Excavating and backfilling for buildings and structures.
3. Laying the subbase course for concrete sidewalks and pavements.
4. Excavating and backfilling for utility trenches.
5. Excavating and backfilling for trenches for buried mechanical and electrical utilities and pits for buried utility structures, as indicated on the Contract Drawings and described in this Section.

1.02 SUBMITTALS

The Contractor shall submit the following shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D2487 of each onsite and borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D1557 for each onsite and borrow soil material proposed for fill and backfill.

B. The Contractor shall submit records before the start of this work. The Contractor shall verify that the existing conditions are correct as shown on the plans and mentioned in these Specifications. The Contractor shall note any discrepancies found immediately and notify the Owner and Engineer.

The records shall include the following:

1. The location of all underground utilities, structures, etc. surrounding the areas to be excavated that may be impacted by the work.
2. The location of test excavations.
3. The location of inspections.

C. Testing Agency Invoices indicating if the invoice is for an initial test or a re-test of the Contractor's work.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
2. ASTM D698—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
3. ASTM D1556/D1556M—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
5. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
8. ASTM D2940/D2940M—Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
9. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
10. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
11. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Occupational Safety and Health Administration (OSHA)

1. OSHA 2226—Trenching and Excavation Safety.

1.04 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and definition testing, as documented according to ASTM D3740.

B. The Contractor shall do the following:

1. Ensure that excavations provide adequate working space and clearance for the work to be performed and for installing piping and buried utilities. In no case shall excavation faces be undercut.
2. Ensure that foundation surfaces are clean and free of loose material of any kind when pipelines and buried utilities are placed on them.
3. Excavate, trench, and backfill in compliance with applicable requirements of governing authorities having jurisdiction.
4. Ensure that shoring and sheeting for excavations are designed by a Florida-registered Professional Engineer and are in accordance with OSHA 2226.
5. Before beginning any excavation or grading, ensure the accuracy of all survey data indicated on the Contract Drawings and in the Specifications and/or as provided. If the Contractor discovers any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Owner so that proper adjustments can be anticipated or ordered. If the Contractor begins any excavation or grading, this shall be considered an acceptance of the survey data by the Contractor, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.
6. Ensure that tolerances for excavation are plus or minus 0.10 foot to the required line and to the required grade. Tolerance for compaction of in-place material shall be plus or minus 0.10 foot to the required grade, unless otherwise noted.
7. Remove unsatisfactory materials and unsuitable materials including muck, silts, peat, and other loose and very loose compressible soils from excavations before placing pipe foundation, bedding, and buried utilities.

1.05 PROJECT CONDITIONS

A. Existing Utilities: The Contractor shall not interrupt utilities serving facilities occupied by the Owner or others unless permitted to do so in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify the Engineer not less than 2 days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without the Engineer's written permission.
3. Contact a utility-locator service and obtain utility locations for the Project area before excavating.

B. The Contractor shall demolish and completely remove from the site underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

1.06 DEFINITIONS

A. *Backfill*: Soil material or controlled low-strength material used to fill an excavation.

1. *Initial Backfill*: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. *Final Backfill*: Backfill placed over initial backfill to fill a trench.

B. *Base Course*: The course placed between the subbase course and hot-mix asphalt paving.

C. *Bedding Course*: The course placed over the excavated subgrade in a trench before laying pipe.

D. *Borrow Soil*: Satisfactory soil imported from off-site for use as fill or backfill.

E. *Drainage Course*: The course supporting the slab-on-grade that also minimizes the upward capillary flow of pore water.

F. *Excavation*: Removing material encountered above subgrade elevations and to lines and dimensions indicated.

1. *Authorized Additional Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. *Unauthorized Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer. Unauthorized excavation as well as remedial work directed by the Engineer shall be without additional compensation.

G. *Fill*: Soil materials used to raise existing grades.

H. *Structures*: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. *Subgrade*: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

J. *Utilities*: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: The Contractor shall provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D2487 Soil Classification Groups SW and SP or a combination of these groups, free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsuitable Soils: Soil Classification Groups GW, GP, GM, GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsuitable soils also include satisfactory soils not maintained within 2% of optimum moisture content at time of compaction.

D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95% passing a 1-1/2-inch sieve and not more than 8% passing a No. 200 sieve.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90% passing a 1-1/2-inch sieve and not more than 12% passing a No. 200 sieve.

F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100% passing a 1-inch sieve and not more than 8% passing a No. 200 sieve.

G. Sand: ASTM C33/C33M; fine aggregate, natural, or manufactured sand.

H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 EXECUTION

3.01 PREPARATION

A. The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. The Contractor shall prepare subgrade for earthwork operations including removing vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Section 02230, Site Preparation.

C. The Contractor shall protect and maintain erosion and sedimentation controls, which are specified in Section 01350, Environmental Protection Procedures.

3.02 DEWATERING

A. The Contractor shall prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding the Project site and surrounding area.

B. The Contractor shall protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system**,** specified in Section 02240, Dewatering, to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: The Contractor shall excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered.

Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsuitable soil materials, replace with satisfactory soil materials.

3.05 EXCAVATION FOR STRUCTURES

A. The Contractor shall excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb the bottom of the excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot. Do not disturb the bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. The Contractor shall excavate surfaces under walks and pavements to indicated lines, cross-sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

A. The Contractor shall excavate trenches to indicated gradients, lines, depths, and elevations.

B. The Contractor shall excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches on each side of pipe or conduit.

C. Trench Bottoms: The Contractor shall excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints,

fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape the bottom of trench to support the bottom 90º of pipe circumference. Fill depressions with tamped sand backfill.
3. Alternately, excavate trenches 4 inches deeper than the bottom of pipe elevation to allow for the bedding course. Hand excavate for bell of pipe.

3.08 SUBGRADE INSPECTION

A. The Contractor shall notify the Engineer when excavations have reached the required subgrade.

B. If the Engineer determines that unsuitable soil is present, the Contractor shall continue excavation and replace with compacted backfill or fill material as directed.

C. The Contractor shall proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll the subgrade in one direction**,** repeating proof-rolling in the direction perpendicular to the first direction. Limit vehicle speed to 3 miles per hour (mph).
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Engineer, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or additional work.

E. As directed by the Engineer, the Contractor shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

A. The Contractor shall fill unauthorized excavation under foundations or wall footings by extending the bottom elevation of concrete foundation or footing to the excavation bottom without altering top elevation. Lean concrete fill, with

28-day compressive strength of 2,500 psi, may be used when approved by the Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. The Contractor shall stockpile excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water.

1. Stockpile soil materials away from edge of excavations. Do not store within the drip line of remaining trees.

3.11 BACKFILL

A. The Contractor shall place and compact backfill in excavations promptly, but not before completing the following:

1. Constructing below finish grade, including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. The Contractor shall place backfill on subgrades free of mud.

3.12 UTILITY TRENCH BACKFILL

A. The Contractor shall place backfill on subgrades free of mud.

B. The Contractor shall place and compact the bedding course on trench bottoms and where indicated. Shape the bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. The Contractor shall backfill trenches excavated under footings and within 18 inches of bottom of footings with suitable soil.

D. The Contractor shall fill trenches with concrete to elevation of bottom of footings. Concrete is specified in Section 03300, Cast-In-Place Concrete.

E. The Contractor shall place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. The Contractor shall backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. The Contractor shall place and compact final backfill of satisfactory soil to final subgrade elevation.

3.13 SOIL FILL

A. The Contractor shall plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. The Contractor shall place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under building slabs, use engineered fill.
4. Under footings and foundations, use engineered fill.

C. The Contractor shall place soil fill on subgrades free of mud.

3.14 SOIL MOISTURE CONTROL

A. The Contractor shall uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compacting to within 2% of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to the specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. The Contractor shall place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. The Contractor shall place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. The Contractor shall compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact the top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95%.
2. Under walkways, scarify and recompact the top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92%.
3. Under lawn or unpaved areas, scarify and recompact the top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90%.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85% in unpaved lawn areas. Final backfill compaction shall meet the requirement listed above depending on the location of the trench.

3.16 GRADING

A. General: The Contractor shall uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross-sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 FIELD QUALITY CONTROL

A. The number and location of the tests shall be as specified in these Specifications and as directed by the Engineer during construction.

B. The Contractor shall coordinate activity with the Engineer and the testing agency to permit testing as directed in the presence of the Engineer.

C. The cost of all testing to achieve specified requirements shall be borne by the Contractor. The Contractor shall be reimbursed by the Owner for passing field tests.

D. The costs of any and all retests due to failure to achieve specified requirements shall be solely borne by the Contractor and are not reimbursable under this Contract.

E. All materials proposed for use shall be tested as follows:

Material	Required Test	Min No. Tests
Satisfactory Soil Materials	Soil Classification using ASTM D2487 (including all tests contained therein)	One per source of materials to determine conformance with materials specified herein; additional test whenever there is any apparent change.
	Soil moisture-density relationship using Modified Proctor ASTM D1557	One per source of material or apparent change in material.

F. The Contractor shall allow the testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after the test results for previously completed work comply with requirements.

G. Footing Subgrade: At footing subgrades, the testing agency will perform at least one test of each soil stratum to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

H. The testing agency will test compaction of soils in place according to ASTM D1556/D1556M, ASTM D2167, ASTM D2937, and ASTM D6938 as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 square feet or less of paved area or building slab, but in no case fewer than three tests.

2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 400 feet or less of trench length but no fewer than two tests.

I. When the testing agency reports that subgrades, fills, or backfills have not achieved the degree of compaction specified, the Contractor shall scarify and moisten or aerate or remove and replace soil to the depth required and recompact and retest until specified compaction is obtained.

J. The approved testing agency shall transmit electronic copies of field-testing results to the Owner and Engineer with hard copies as requested.

The field test reports shall include, at a minimum, project title; project location; location of sample(s) tested; time of testing; date of testing; testing person's full name; testing agency name, address, and telephone number; and test results.

K. No soil material shall be used until (1) the Engineer has reviewed and approved test reports and (2) the Contractor submits certification that the soil material proposed for construction is clean and meets gradation and other parameters specified in this Specification.

L. At no cost to the Owner, the Contractor shall remove and replace or correct all materials and work which tests indicate do not conform, in the opinion of the Engineer, to the requirements of these Specifications.

M. The results of in-place density tests shall be considered satisfactory if the density in each instance is equal to or greater than the specified density. Soil moisture content at the time of testing shall conform to requirements of these Specifications.

N. Where unsatisfactory compaction is revealed by the tests, the Contractor shall re-excavate, backfill, recompact, and/or rework the backfill as required to obtain the required degree of compaction over the entire depth of the excavation.

O. The testing agency shall transmit to the Engineer copies of all testing agency invoices submitted to the Contractor for payment. Invoices shall clearly indicate specific services and date and time services are rendered and shall indicate if the invoiced testing cost is an initial test of the Contractor's work or is a re-test required due to the Contractor's failure to initially achieve the specified requirements.

3.18 PROTECTION

A. Protecting Graded Areas: The Contractor shall protect newly graded areas from traffic and erosion and keep them free of trash and debris.

B. The Contractor shall repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by the Engineer and reshape and recompact.

C. Where settling occurs before the Project Correction Period elapses, The Contractor shall remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: The Contractor shall transport surplus satisfactory soil to designated storage areas on the Owner's property and stockpile and spread this soil as directed by the Engineer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

SECTION 02305
EARTHWORK FOR UTILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all materials, equipment, labor, and work necessary to completely construct the project in accordance with the Contract Documents. This work includes but is not limited to the following:

1. Excavating and removing unsatisfactory materials.
2. Preparing trench foundations.
3. Providing satisfactory material for all trenches as specified and as required.
4. Obtaining, storing, maintaining, and disposing of materials.
5. Dewatering, shoring, and sheeting.
6. Placing, compacting, testing, final grading, and demolishing subgrade.
7. Performing all other work required by the Contract Documents.

B. The Contractor is responsible for performing all work so as not to damage existing roadways, facilities, utilities, structures, etc. and shall repair and replace such damage to equal or better than its original undamaged condition without cost to the Owner.

C. The Contractor shall examine the site before submitting a bid, taking into consideration all conditions that may affect the work.

D. The Contractor shall coordinate all additional subsurface investigations and testing included with this work with the Engineer before performing the excavation and foundation preparation work. In general, if the Contractor finds different and unsuitable/unsatisfactory soil conditions during the work, the Contractor shall notify the Engineer and the Owner immediately.

1.02 SUBMITTALS

The Contractor shall submit the following shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D2487 of each onsite and borrow soil material proposed for fill and backfill.

2. Laboratory compaction curve according to ASTM D1557 for each onsite and borrow soil material proposed for fill and backfill.

B. The Contractor shall submit records before the start of this work. The Contractor shall verify that the existing conditions are correct as shown on the plans and mentioned in these Specifications. The Contractor shall note any discrepancies found immediately and notify the Owner and Engineer.

The records shall include the following:

1. Location of all existing underground utilities, structures, etc. surrounding the areas to be excavated that may be impacted by the work.
2. Location of test excavations.
3. Location of inspections.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply:

A. American Society for Testing and Materials (ASTM)

1. ASTM D1556/D1556M—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
3. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
5. ASTM D3282—Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
6. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction.
7. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
8. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Florida Statutes (FS)

1. Florida Trench Safety Act (90-96, Laws of Florida).

C. Occupational Safety and Health Administration (OSHA)

1. 29 CFR 1926, Subpart P—Safety and Health Regulations for Construction, Excavations.
2. OSHA 2226—Trenching and Excavation Safety.

1.04 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and definition testing, as documented according to ASTM D3740.

B. The Contractor shall do the following:

1. Ensure that excavations provide adequate working space and clearance for the work to be performed and for installing piping and buried utilities. In no case shall excavation faces be undercut.
2. Ensure that foundation surfaces are clean and free of loose material of any kind when pipelines and buried utilities are placed on them.
3. Excavate, trench, and backfill in compliance with applicable requirements of governing authorities having jurisdiction.
4. Ensure that shoring and sheeting for excavations are designed by a Florida-registered Professional Engineer and are in accordance with OSHA 2226.
5. Before beginning any excavation or grading, ensure the accuracy of all survey data indicated on the Contract Drawings and in these Specifications and/or as provided. If the Contractor discovers any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Owner so that proper adjustments can be anticipated or ordered. If the Contractor begins any excavation or grading, this shall be considered an acceptance of the survey data by the Contractor, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.
6. Ensure that tolerances for excavation are ±0.10 foot to the required line and to the required grade. Tolerance for compaction of in-place material shall be ±0.10 foot to the required grade.
7. Ensure that all trench materials derived from the project site and imported to this site are examined, tested, and classified by an Engineer-approved soils testing laboratory.

8. Remove unsatisfactory materials and unsuitable materials including muck, silts, peat, and other loose and very loose compressible soils from excavations before placing pipe foundation, bedding, and buried utilities.

1.05 PROJECT CONDITIONS

A. Existing Utilities: The Contractor shall not interrupt utilities serving facilities occupied by the Owner or others unless permitted to do so in writing by the Engineer and then only after arranging to provide temporary utility services according to the requirements indicated.

1. Notify the Engineer not less than 2 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Engineer's written permission.
3. Contact utility-locator service and obtain utility locations for the Project Area before excavating.

B. The Contractor shall demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

1.06 DEFINITIONS

A. *Backfill*: Soil material or controlled low-strength material used to fill an excavation.

1. *Initial Backfill*: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. *Final Backfill*: Backfill placed over initial backfill to fill a trench.

B. *Base Course*: The course placed between the subbase course and hot-mix asphalt paving.

C. *Bedding Course*: The course placed over the excavated subgrade in a trench before laying pipe.

D. *Borrow Soil*: Satisfactory soil imported from off-site for use as fill or backfill.

E. *Drainage Course*: The course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. *Excavation*: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. *Authorized Additional Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to the Contract provisions for unit prices.
2. *Bulk Excavation*: Excavation more than 10 feet in width and more than 30 feet in length.
3. *Unauthorized Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be without additional compensation.

G. *Fill*: Soil materials used to raise existing grades.

H. *Structures*: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. *Subgrade*: The surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

J. *Utilities*: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.07 TESTING REQUIREMENTS

A. The Contractor shall furnish a soil survey for satisfactory material and samples of materials.

B. Testing for source material, for classification, and for prequalification of material (on or off site) shall be performed by an independent testing agency retained by the Contractor and approved by the Engineer.

C. Testing for in-place compacted fill shall be performed by the same independent testing agency as approved by the Engineer and retained by the Contractor.

D. The number and location of the tests shall be as specified in these Specifications and as directed by the Engineer during construction.

E. The Contractor shall coordinate activity with the Engineer and the testing agency to permit testing as directed in the presence of the Engineer.

F. The cost of all testing to achieve specified requirements shall be borne by the Contractor. The Contractor shall be reimbursed by the Owner for passing field tests.

G. The costs of any and all retests due to failure to achieve specified requirements shall be solely borne by the Contractor and are not reimbursable under this contract.

H. All materials proposed for use shall be tested as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Materials	Soil Classification using ASTM D2487 (including all tests contained therein)	One per source of materials to determine conformance with materials specified in these Specifications; additional tests whenever there is any apparent change.
	Soil moisture-density relationship using Modified Proctor ASTM D1557	One per source of material or apparent change in material.

I. Soil materials shall be tested during construction as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Material in-place after compaction	Field Density ASTM D1556/D1556M – Sand Cone Method, or ASTM D6938 – Nuclear Density Method, or ASTM D2937 – Drive Cylinder Method	For each layer of trench bottom subgrade before addition of soil materials, refill, bedding, and backfill, and for each 400 lineal feet of trench or fraction thereof, whichever is greater; two tests for each drainage, manhole, or wet well structure; additional test whenever there is any change in native soil, groundwater, or soil moisture conditions.

J. The approved testing agency shall transmit electronic copies of required laboratory test results to the Owner and Engineer with hard copies as requested.

1. The laboratory test reports shall include, at a minimum, project title; project location; location of sample; source, time, and date of testing; testing agency's name, address, and telephone number; and test results. Each test report shall be signed and sealed by the Professional Engineer representing the testing agency as specified in these Specifications.
2. The approved testing agency shall transmit electronic copies of field-testing results to the Owner and Engineer with hard copies as requested. The field test reports shall include, at a minimum, project title; project location; location of sample(s) tested; time of testing; date of testing; testing person's full name; testing agency name, address, and telephone number; and test results.

K. No soil material shall be used until 1) the Engineer has reviewed and approved test reports and 2) the Contractor submits certification that the soil material proposed for construction is clean and meets gradation and other parameters specified in these Specifications.

L. At no cost to the Owner, the Contractor shall remove and replace or correct all materials and work that tests indicate do not conform, in the opinion of the Engineer, to the requirements of these Specifications.

M. The results of in-place density tests shall be considered satisfactory if the density in each instance is equal to or greater than the specified density. Soil moisture content at the time of testing shall conform to requirements of these Specifications.

N. Where the tests reveal unsatisfactory compaction, the Contractor shall re-excavate, backfill, recompact, and/or rework the backfill as required to obtain the required degree of compaction over the entire depth of the excavation.

O. The testing agency shall transmit to the Engineer copies of all testing agency invoices submitted to the Contractor for payment. Invoices shall clearly indicate specific services and date and time services are rendered and shall indicate if the invoiced testing cost is an initial test of the Contractor's work or is a re-test required due to the Contractor's failure to initially achieve the specified requirements.

PART 2 PRODUCTS

2.01 STRUCTURAL MATERIALS

A. Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and cross-braces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.

B. Pressure-treated timber shall be used where wood sheeting or piling is specified or indicated to be cut and left in place.

2.02 TRENCH SOIL MATERIALS

A. Materials used for trench construction shall be free of clumps of clay, rock or gravel, debris, waste, frozen materials, and other deleterious matter as determined by the Engineer and shall be satisfactory soil materials as follows:

Area Classification	Soil Materials
In excavations and trenches	Excavated and borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material."

B. Satisfactory Soil Materials

1. Soil Classification Groups: Satisfactory soil materials for each trench shall be as follows:

Satisfactory Soil Material (ASTM D3282, Soil Classification Groups)		
In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
SW SP	SW SP	SW SP

2. Maximum Particle Size Limitations for Satisfactory Soil Materials: The maximum allowable particle size for satisfactory soil materials within each trench for each type of utility shall be as follows:

Conduit	Maximum Allowable Particle Size		
	In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
Plastic Pipe (PVC, CPVC, HDPE, etc.) less than 6-inch-diameter	See Note 1	1/2 inch	3 inches
Plastic Pipe (PVC, CPVC, HDPE, etc.) 6-inch-diameter and Larger	See Note 1	3/4 inch	3 inches
Concrete Pipe			
Steel Pipe			
Ductile Iron Pipe			
Fiberglass Pipe	See Note 1	3/4 inch or three times the wall thickness, whichever is less	3 inches
Other Conduit Materials	See Note 2	See Note 2	See Note 2

(1) There is no requirement when satisfactory undisturbed native soil material is used. Disturbed portions of the foundation and/or unsatisfactory native soil material shall be replaced with satisfactory soil materials meeting all the requirements for Bedding.
(2) The maximum allowable particle size shall be in accordance with the manufacturer's written recommendation.

3. Additional Requirements of Satisfactory Materials: Satisfactory soil materials shall be free of debris, waste, frozen materials, vegetation, or other deleterious matter. Soils within 4 inches of the exterior surface of the pipe shall be free of gravel, stones, or other materials that may abrade the pipe surface.

C. Unsatisfactory Materials: Unsatisfactory soil material shall mean ASTM D2487, Soil Classification Groups GW, GP, GM, GC, SC, CL, ML, OL, CH, MH, OH, PT, and other highly organic soils and soil materials of any classification that

have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

The Contractor shall do the following:

A. Carefully verify by hand methods the location of all surrounding underground utilities before performing utility excavations and trenches.

B. Protect utilities to be left in place from damage.

C. Do not interrupt existing utilities serving facilities occupied and used by the Owner, except when permitted in writing by the Owner.

D. Protect benchmarks, survey points, and existing structures, roads, sidewalks, monitoring wells, paving, curbs, etc. against damage from equipment, vehicular or foot traffic, settlement, lateral movement, undermining, washout, and all construction-related activities.

E. Repair and replace damage to existing facilities to equal or better than their original undamaged condition without cost to the Owner and to the approval of the Engineer.

F. Excavate and trench in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.

G. Protect excavations and trenching by shoring, bracing, sheet piling, underpinning, or other methods as required to prevent cave-ins or loose dirt from falling into excavations and trenches.

H. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for depositing or compacting backfill material.

I. Compact the backfill material placed next to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.

J. Excavate, fill, backfill, and grade to elevations required by the Contract Documents.

K. Pile excavated materials suitable for backfill in an orderly manner a sufficient distance from excavations to prevent overloading, slides, and cave-ins.

L. Do not obstruct access ways, roadways, and plant facilities.

M. Dewater excavations and trenches in accordance with Section 02240, Dewatering.

N. Refer to the Contract Drawings for additional requirements related to earthwork and protection of existing features.

3.02 TRENCH EXCAVATION

A. Before excavating the trench, the Contractor shall prepare the surface including clearing and grubbing as specified in Section 02230, Site Preparation.

B. The Contractor shall be required to fully comply with all applicable OSHA Excavation Safety Standards and to abide by them as covered by the most current version of the Florida Trench Safety Act (90-96, Laws of Florida).

C. The Contractor shall ensure that mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be so operated that conduit/utility, when accurately laid to specified alignment, will be centered in the trench with adequate clearance between the conduit/utility and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

D. The Contractor shall not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, other existing property, utilities, structures, etc. above or below ground. In all such locations, the Contractor shall use hand-excavating methods.

E. The Contractor shall not use blasting.

F. The Contractor shall cut trenches sufficiently wide to enable proper installation of services and to allow for testing and inspection. The Contractor shall also trim and shape trench bottoms and leave them free of irregularities, lumps, and projections. Trench width shall be excavated as specified on the Contract Drawings.

G. The Contractor shall construct trench walls to avoid side wall collapse or sloughing. Trenches shall be either braced or open construction in accordance with the Contract Documents. No separate payment will be made for any special procedure used in connection with the excavation.

H. Where sheeting and bracing are not required, the Contractor shall construct trench walls in the bottom of the excavation as vertical as possible to the maximum height allowable by OSHA. Trench walls above this height shall be sloped to

guard against side wall collapse or sloughing as specified on the Contract Drawings.

I. Where sheeting and bracing are required, the sheeting and bracing system shall meet the requirements in these Specifications.

J. Excavations shall be to the design elevations shown on the Contract Drawings or as specified, unless unsatisfactory or unsuitable foundation materials are encountered in the bottom of the excavation. Where unsatisfactory or unsuitable foundation materials are encountered, this material shall be undercut and removed as indicated on the Contract Drawings and replaced with satisfactory soil material meeting all the requirements for Bedding. The lift thicknesses and compaction requirements for the replacement soil shall also meet the requirements for Bedding.

K. The Contractor shall be careful not to overexcavate except where necessary to remove unsatisfactory or unsuitable materials, irregularities, lumps, rock, and projections. Unnecessary overexcavation shall be replaced as specified in these Specifications at the Contractor's sole expense.

L. The Contractor shall accurately grade bedding soil materials at the bottoms of the trenches to provide uniform bearing and support for each section of conduit/utility at every point along its entire length except where it is necessary to excavate the bedding for conduit/utility bells (e.g., pipe bells), etc. or for proper sealing of conduit/utility joints. Abrupt changes in grade of the trench bottom shall be avoided.

M. The Contractor shall dig bell holes and depressions after the bedding has been graded to ensure that the conduit/utility rests on the prepared bedding for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint.

N. The Contractor shall do the following:

1. Pile all excavated material in a manner that will not endanger the work or erode the stormwater management facilities or water courses.
2. Avoid obstructing sidewalks, driveways, and plant facilities.
3. Leave hydrants, valve pit covers, valve boxes, or other utility controls unobstructed and accessible.
4. Keep gutters, drainage inlets, natural water courses, and miscellaneous drainage structures clear or make other satisfactory provisions for their proper operation.

O. The Contractor shall keep all satisfactory materials that are suitable for use/reuse in the trench construction separated from unsatisfactory materials.

P. Except where otherwise authorized, indicated, or specified, the Contractor shall replace, at the Contractor's own expense, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations with concrete or flowable fill, as directed by the Engineer.

Q. The Contractor shall adhere to these Additional Excavation Requirements for piping:

1. Excavate trenches so that the piping can be laid to the lines, grades, and elevations indicated on the Contract Drawings.

2. For piping designated to be laid to a minimum cover requirement, grade trenches to avoid high and low points to the extent practical. Record Drawings of such pipes shall present top-of-pipe and grade elevations at all high and low points along each pipe segment, at the end points of each pipe segments, and at intervals not to exceed 100 feet along each pipe segment. If, in the opinion of the Engineer, additional air release and/or vacuum relief valves are required, the Contractor shall install the additional items as directed by the Engineer.

3. Except at locations specifically indicated otherwise on the Contract Drawings, the required minimum cover over the top of the pipe from finished grade for various pipe diameters shall be as follows:

	Pipe Diameter			
	48-inch or less	66-inch	72-inch	96-inch
Minimum Cover	3 feet	4 feet	4.5 feet	5 feet

Continue dewatering operations along each pipe segment until the required minimum cover is provided. During the dewatering operations, the ground water level in the trench shall remain at all times a minimum of 1 foot below bottom of trench excavations.

R. The Contractor shall adhere to these Additional Excavation Requirements for Electrical Utilities:

1. Avoid abrupt changes in grade of the trench bottom.

2. The required minimum cover over the top of electrical conduits from finished grade shall be as follows:

	Electrical Conduits (Lines less than 5 kV)	Electrical Conduits (Lines 5 kV and up)
Minimum Cover	2 feet	3 feet

3. The required minimum clearance from the bottom of mat foundations and/or footings shall be 2 feet. Provide additional cover where necessary to satisfy the minimum clearance requirement.

4. Provide additional cover depth, if necessary, to avoid interference of other cables, ducts, piping, structures, and other utilities.

S. The Contractor shall adhere to this Additional Excavation Requirement for Appurtenances:

1. Ensure that excavations for valves and similar appurtenances shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls.

3.03 PROTECTION OF PERSONS AND PROPERTY

A. The Contractor shall do the following:

1. Barricade and post excavations with warning signs for the safety of persons. Provide warning lights during hours of darkness.
2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations against damage including loading, settlement, lateral movement, undermining, and washout.

B. Conduct topsoil removal operations to ensure the safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

3.04 SHEETING AND BRACING

A. Where sheeting and bracing are required to support the side walls of the excavation, the Contractor shall retain a Professional Engineer, registered in Florida, to design sheeting and bracing. The design shall establish requirements for sheeting and bracing and shall comply with all applicable codes; authorities having jurisdiction; and federal, state, and local regulations.

B. The sole responsibility for the design, methods of installation, and adequacy of sheeting and bracing shall be and shall remain that of the Contractor and the Contractor's Professional Engineer. The Contractor shall provide all necessary sheeting and bracing or other procedures as required to ensure safe working conditions and to protect the excavations.

C. Sheeting and bracing shall consist of braced steel sheet piling, trench box, braced wood lagging, and soldier beams or other approved methods.

D. The Contractor shall immediately fill and compact voids formed outside the sheeting. Where soil cannot be properly compacted to fill the void, the Contractor shall use Class B concrete as backfill at no additional cost to the Owner.

E. The Contractor shall install sheeting outside the required clearances and dimensions. Sheeting shall be plumb, securely braced, and tied in position. Sheeting shall be adequate to withstand all pressure to which it may be subjected. The Contractor shall correct any movement or bulging at no expense to the Owner to provide the necessary clearances and dimensions.

F. The Contractor shall maintain sheeting and bracing in excavations and trenches for the entire time excavations will be open.

G. The Contractor shall not brace sheeting against pipe being laid. Sheeting shall be braced so that no concentrated load of horizontal thrust is transmitted to the pipe.

H. Sheeting shall not be withdrawn if driven below the spring line of any pipe. The Contractor shall cut off tops as indicated on the Contract Drawings and leave bottoms permanently in place.

3.05 DEWATERING, WATER REMOVAL, AND DRAINAGE MAINTENANCE

A. Water shall not be permitted to accumulate in excavations. The Contractor shall provide dewatering systems to convey water away from excavations so that softening of foundations bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be as specified in Section 02240, Dewatering, and as approved by the Engineer before being installed by the Contractor. Groundwater levels shall be maintained a minimum of 1 foot below bottom of trenches or excavations.

B. Dewatering systems and equipment shall be in place as required to eliminate water during the excavation period until the work is completed. The Contractor shall provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation. This includes the use of

sand or gravel as required to maintain adequate flow during the pipe laying or installation of other items of work within the excavation.

C. Water pumped or drained shall be disposed of in a suitable manner without damage to adjacent property, to other work under construction, or to roads. Water shall not be discharged onto surface improvements without adequate protection of the surface at the point of discharge. All gutter, drains, culverts, sewers, and inlets shall be kept clean and open for surface drainage. Water shall not be directed across or over pavements except through approved pipes or properly constructed troughs. The Contractor shall obtain permission from the Owner of any property involved before constructing water courses or installing discharge pipe or hose for removal of water and provide for disposal of the water without ponding or creating a public nuisance.

D. All pumps used for dewatering shall have noise-reduction features and shall be able to run continuously with minimal attendance. If required by the Owner or Engineer, the pumps shall be enclosed on all sides with a plywood enclosure, with padded material suitable for outdoor conditions on the inside of the enclosure, to further reduce pump engine noise to an acceptable level. All applicable ordinances and codes for noise abatement shall be followed. The Contractor shall maintain pumps at all times, as necessary. When pumps are no longer required, the Contractor shall remove the pumps, wellpoints, pipes, and other apparatus from the area.

E. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or storm sewers.

F. Trenches shall be constructed on the upstream side of the traffic way across roadways, driveways, or other traffic ways adjacent to drainage ditches or water to prevent impounding water after the pipe has been laid. The Contractor shall construct and maintain bridges and other temporary structures required to maintain traffic across such unfilled trenches. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. After backfilling is completed, the Contractor shall immediately remove all material deposited in roadway ditches or other water courses crossed by the line of trench and restore the original section, grades, and contours of ditches or water courses. Surface drainage shall not be obstructed longer than necessary.

G. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1%, the Contractor shall install ditch checks. Unless otherwise indicated on the Contract Drawings, ditch checks shall be concrete or as otherwise approved by the Engineer. Ditch checks shall extend not less than 2 feet below the original ditch or water course bottom for the full bottom width and at least 18 inches into the side slopes and shall be at least 12 inches thick.

3.06 BACKFILLING AND COMPACTION

A. The Contractor shall not backfill trenches until required tests are performed.

B. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.

C. The Contractor shall perform the following steps to ensure compaction at the bottom of the trench or excavation before bedding:

1. Remove disturbed native soil material and/or any soils not meeting the requirement of satisfactory soil material as indicated on the Contract Drawings.
2. Compact the bottom of the trench excavation (undisturbed native subsurface soil) to no less than 95% of the Modified Proctor maximum dry density in accordance with ASTM D1557, before placement of foundation, bedding, piping, and backfill.

D. To backfill below and around pipe to the spring line of the pipe, the Contractor shall do the following:

1. Construct foundation and bedding as indicated on the Contract Drawings before placement of pipe.
2. Install each pipe at proper grade, alignment, and final position.
3. Deposit satisfactory soil material uniformly and simultaneously on each side of pipe in completed course layers to prevent lateral displacement.
4. Compact under pipe haunches and on each side of pipe to the pipe spring line as shown on the Contract Drawings to hold the pipe in the proper position during subsequent pipe backfilling and compaction operations.
5. Construct haunching as indicated on the Contract Drawings.

E. To trench backfill above pipe spring line to finished grade, the Contractor shall do the following:

1. Deposit satisfactory soil material around and above pipe in uniform layers as shown on the Contract Drawings.
2. Backfill and compact trenches from the spring line of the pipe to the top of the trench in completed course layers as shown on the Contract Drawings.
3. Use material previously defined in these Specifications as satisfactory soil material.
4. Compact by hand or mechanical tampers.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. The Contractor shall remove and legally dispose of waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris from the property at no additional cost to the Owner.

END OF SECTION

SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.

B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Department of Transportation (FDOT)

1. FDOT Section 103—Temporary Work Structures.
2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
3. FDOT Section 530—Revetment Systems.
4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geosynthetic Materials.

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.05 PRACTICES

The Contractor shall adhere to the following:

A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

1.06 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.

C. Filter fabric or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

D. The Contractor shall use silt fences and floating turbidity barriers as shown on the plans or as directed by the Owner or Owner’s Representative to restrict movement of sediment from the site.

E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

PART 2 PRODUCTS

2.01 GENERAL

A. Open-mesh biodegradable mulching cloth.

B. Fertilizer shall be 10-10-10 grade or equivalent.

C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.

D. Grass shall be in accordance with Section 02920, Seeding and Sodding.

E. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.

F. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Section 104.

G. Erosion Stone: FDOT Section 530.

1. Sand-Cement Riprap.
2. Concrete Block.
3. Rubble 20 to 300 pounds each.

H. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.

I. Sediment barriers in accordance with FDOT Section 104.

PART 3 EXECUTION

3.01 CLEARING

A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

3.02 STABILIZING

A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

3.03 REGULATORY REQUIREMENTS

A. Whenever land-disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract upon which further active construction is to be undertaken.

B. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

3.04 VEGETATIVE COVER

A. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of 4 inches until a firm, well-pulverized, uniform seedbed is prepared. Fertilizer shall be applied during the scarification process in accordance with the following rates:

1. Fertilizer—10 to 15 pounds per 1,000 square feet.

B. Seeding. Disturbed areas along embankments shall be permanently seeded with mix specified in Section 02920, Seeding and Sodding.

C. The Contractor shall mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified previously in this Section.

3.05 MAINTENANCE

A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional

payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.

B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established. The Contractor shall seed areas around devices and mulch after removing or filling temporary control devices.

B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

SECTION 02530
PIPEWORK, GRAVITY SEWER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all work necessary for constructing a gravity sewer system. This work shall include the installation of all gravity sewer lines, services, manholes, fittings, and appurtenances as may be required to complete the work as indicated in the plans.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, shop drawings, and other necessary information to the Engineer for approval before installing pipes and manholes.

C. Testing: The Contractor shall submit the proposed methods of gravity system testing to the Engineer for approval before scheduling and conducting testing.

D. Certifications: The Contractor shall submit a certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

The latest edition of the "Ten States Standards" and applicable Standard Details and Specifications shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section, with exceptions as noted.

A. American Society of Testing and Materials (ASTM)

1. ASTM A48/A48M—Standard Specification for Gray Iron Castings.

2. ASTM A536—Standard Specification for Ductile Iron Castings.
3. ASTM A746—Standard Specification for Ductile Iron Gravity Sewer Pipe.
4. ASTM C32—Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
5. ASTM C144—Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C150/C150M—Standard Specification for Portland Cement.
7. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
8. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
9. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
10. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
11. ASTM D1748—Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet.
12. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
13. ASTM D2241— Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
14. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
15. ASTM D3034—Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
17. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
18. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
19. ASTM F794—Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
20. ASTM F1417—Standard Practice for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.

B. American Water Works Association (AWWA)

1. AWWA C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.

3. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 60-Inch (100 mm through 1,500 mm).

C. Federal Specifications and Standards (FSS)

1. FSS A-A-60005—Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.

B. Delivery, storage, and handling shall be in accordance with the manufacturer's recommendations.

PART 2 PRODUCTS

2.01 GENERAL

A. The Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All material supplied shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

2.02 PIPE

A. Polyvinyl Chloride (PVC): Manufacture in accordance with ASTM D3034, minimum SDR 35, for pipe depths up to 12 feet deep only. For pipe over 12 feet deep, use AWWA C900 PVC, DR 18, or ductile iron pipe (DIP) epoxy lined. PVC pipe shall have a cell classification of 12454B or 12364C as defined under ASTM D1784. PVC pipe shall comply with and be labeled as approved by the NSF for use in a sanitary sewer. No solvent- cement weld pipe will be accepted. The color must be green.

1. Fittings and Joints: Bell and spigot type with elastomeric gasket installed in accordance with ASTM D3212 and ASTM D3034. Gaskets shall conform to ASTM F477 for joining plastic pipe.

2. Nonmetallic Marking Tape: Install in accordance with Section 15055, Piping Systems—General, Paragraph 2.16.A.
3. Tracer Wire: Install in accordance with Section 15055, Piping Systems—General, Paragraph 2.16.A.

2.03 MANHOLES

A. Manholes shall be in accordance with Section 03490, Polymer Concrete Manholes and Pump Stations.

2.04 FLEXIBLE MANHOLE-TO-PIPE CONNECTOR

A. The manhole-to-pipe connector shall be manufactured from Neoprene EPDM. The connector shall be a minimum of 3/8-inch thick and shall conform to ASTM C443. The connector shall be resistant to ozone, weathering, aging, chemicals, animal and vegetable fats, oils, and petroleum products.

B. The connector shall be sized for the specific type and size pipe entering and leaving each manhole. The connector shall be precast into the manhole by the manhole manufacturer in accordance with the connector manufacturer's written instructions. A 304 stainless steel band and screw assembly shall be provided to seal the flexible neoprene connector against the pipe.

C. Acceptable Manufacturers: PSX, Kor-N-Seal, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The Contractor shall install all pipework meeting the requirements of AWWA for installing polyvinyl chloride for the various types and classes of pipe. Lay all gravity sewers using laser beam methods. Obtain exact grade and alignment for each pipe by measuring to the invert of the pipe. Lay pipe upgrade, beginning at the lower end of the sewer, with pipe bell ends up-grade. Exercise extreme care to keep the pipe in exact alignment and elevation. It is the Contractor's responsibility to make exploratory excavations and/or use other methods available to locate existing utilities before constructing any gravity sewers. If necessary, the Contractor shall adjust the new sewers, subject to approval by the Engineer, to avoid conflicts with existing piping. Install pipe joints on each line entering or leaving manhole, including stub lines, as close to the manhole exterior wall as practical. In no case shall the pipe be walked on either before or after the joints have been made. Securely close all openings such as stubs, wyes, or other services along the lines with approved stoppers that fit into the bells of the pipe and are recommended by the pipe manufacturer. Install

stoppers in such a manner that they may be removed at some future time without injury to the pipe bells. No bricking or grouting plugs in lines will be permitted.

B. Laying Pipe: Take all necessary precautions to prevent mud, sand, or other obstructing matter entering the pipelines. Lay pipe on bedding prepared in accordance with ASTM D1557 and a minimum of 90% density bedding for the pipe installed, in accordance with the plans and Earthwork sections of these Specifications; provide uniform bearing under the full length of the pipe barrel. Excavate for pipe bells and carefully lay pipe true to line and grade. Make adjustments to line and grade by scraping away or filling in and tamping under the pipe barrel and not by wedging or blocking up any portion of the pipe. Abut the spigot end of each pipe against the base of the socket of the adjacent pipe in such a manner that there will be no unevenness of any kind along the bottom halves of the pipes. Immediately after the pipe has been jointed and inspected, compact sufficient backfill to protect the pipe adequately from injury and movement. At the close of each day's work and at other times when pipe is not being laid, protect the end of the pipe with a close-fitting stopper approved by the Engineer. Replace with sound pipe any defective pipe which may have been laid. Upon completion, installed pipe lines shall show a full circle of light when lamped between manholes.

C. Joints: The Contractor shall submit the specific type of joint to be used on all pipe, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.

D. Manhole Construction: The Contractor shall construct manholes as shown and specified or directed in these documents. Install manhole watertight seal on pipe passing through manhole walls or install approved manhole connectors in manhole walls for connection of pipe. Manhole installation shall be as shown and in strict compliance with the manufacturer's printed instructions where specials are used for connections.

1. Manhole Installation shall be in accordance with Section 03490, Polymer Concrete Manholes and Pump Stations.
2. Setting Manhole Frames: Spacer risers for the top riser under frame: Use no mortar that has begun to set. Lay concrete risers in mortar bed on the top of corbel. Joints shall be struck flush and the interior and exterior of the manhole plastered with 1/2-inch-thick coat of mortar to leave a dense, smooth finish so that the manhole shall be watertight. Set manhole frames and lids flush with finish pavement or 0.1 foot above the finished grade unless shown or directed otherwise by the Engineer. Set frames on manholes concentric with the masonry and in a full bed of mortar so that

the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Place a ring of mortar around the outside of the bottom flange at least 1 inch thick and pitched to shed water away from the frame. Extend mortar to the outer edge of the masonry and finish smooth and flush with the top of the flange.

E. Drop Connections: Where shown on the Drawings or directed by the Engineer, the Contractor shall construct drop connections to the manholes as shown and specified in this Section. Provide pipe restraints and supports as required.

F. Stub Lines: The Contractor shall provide plugged stub lines where shown or directed by the Engineer for the connection of future sewer lines to manholes. Provide bell end closed with an approved stopper, as specified in Article 3.01, Installation, at the end of each stub line. Install bell of stub line as close to the manhole exterior's surface as practical. Accurately reference each stub line size for direction and record complete with the actual invert elevation. Furnish the Engineer with two copies of the data on stub lines.

G. Cleanouts: Construct as detailed using pipe and fittings as specified in this Section. Applicable portions of these Specifications shall apply to the construction of this item.

3.02 INSPECTION AND TESTING

A. General

1. The Contractor shall inspect all work constructed for faults or defects and any deviation from these documents or omissions shall be corrected at once. The Contractor shall conduct all tests and shall provide necessary equipment and personnel for lamping the system in the presence of the Engineer. The Contractor shall bear all costs for these tests and inspections.
2. Sewers shall be tested by a low-pressure air test.
3. Pipe testing shall closely follow pipe laying. No more than 1,000 feet of pipe shall remain untested at any time.

B. Gravity Piping

1. The Contractor shall submit the proposed method of testing to the Engineer for approval. Air testing shall be performed in accordance with the procedures described in ASTM F1417. The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air

safety valve set to prevent the air pressure in the pipeline from exceeding 8 psig. If the results of the air test are unsatisfactory, perform the exfiltration test as outlined above.

2. The following low-pressure air testing procedures may be used. The sewer line shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line will contain an on/off gas valve and a pressure gauge with a range of 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of ±0.04 psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure. The pipe line under test shall be pressurized to 4 psig. The line will be allowed to stabilize between 4 psig and 3.5 psig for no less than 5 minutes. If necessary, air shall be added to the line to maintain the pressure above 3.5 psig. After the stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 psig, timing will begin with a stop watch. The stop watch shall be allowed to run until the line pressure drops to 2.5 psig. The watch shall then be stopped and the time lapse shall be compared to the allowable time lapse in these Specifications. If the time lapse is greater than that specified, the section undergoing the test shall have passed the low-pressure air test and the test will be discontinued at that time. If the time is less than that specified, the line has not passed the test (see Table 1 for test times).

Table 1 Minimum Time for a 1.0-psig Pressure Drop for Size and Length of Pipe for $Q = 0.0015$

Pipe Diameter (inches)	Minimum Time (min:sec)	Length for Minimum Time (feet)	Time for Longer Length (L) (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	0.380	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15
33	31:10	72	25.852	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53
36	34:00	66	30.768	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46
42	39:48	57	41.883	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07

Table 1 Minimum Time for a 1.0-psig Pressure Drop for Size and Length of Pipe for $Q = 0.0015$											
Pipe Diameter (inches)	Minimum Time (min:sec)	Length for Minimum Time (feet)	Time for Longer Length (L) (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
48	45:34	50	54.705	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17
54	51:02	44	69.236	115:24	173:05	230:47	288:29	346:11	403:53	461:34	519:16
60	56:40	40	85.476	142:28	213:41	284:55	356:09	427:23	498:37	569:50	641:04

Notes: 1-See Practice UNI-B-6.
2-Consult with pipe and appurtenance manufacturer for maximum test pressure for pipe size greater than 30 inches in diameter.

C. Infiltration: After the work is complete, the sewers or sections shall be tested for infiltration. Any section in which the infiltration of water is detected will be rejected until corrective work has been performed. No infiltration will be allowed for any main or segment between manholes.

D. Exfiltration: The Engineer may require tests for exfiltration. Exfiltration shall be in accordance with the requirements of ASTM requirements as modified by the Engineer. An allowance of 10 % of exfiltration gallonage shall be permitted for each additional 10-foot head over the basic top-of-manhole head.

E. Television Inspection: All new sewer mains shall be inspected by internal television inspection, providing accurate distances to all services, with logs and video record of inspection. The Contractor shall provide all equipment and labor for such inspection. Any Sub-Contractor must be approved by the Owner before work. Acceptable procedures for televising and video recording are available at the Public Works Department. Digital video recordings shall be taken of all inspection, including the manholes. The Contractor shall prepare the DVD and after review by the Engineer it shall be delivered to the Owner. The Engineer or Owner’s representative shall observe the television inspection.

F. Alignment and Deflection: Lines shall show full circle of light when lamped between manholes for line sections with complete pipe replacement.

1. A nine-point mandrel shall be passed through each new flexible pipe section installed after full backfill has been placed. The maximum pipe diameter deflection shall not exceed 5 %.

G. Warranty Test: To ensure the adequacy of the pipe described above and the manhole installation procedures, the Contractor shall remobilize to the work site 10 months after final approval-acceptance of the complete project, such time being within the 1-year warranty period, as stated in the General Conditions. The

date for such remobilization will be stated in the Final Approval issued by the Engineer.

1. The Contractor, together with representatives of the Engineer and the Owner, shall visually inspect every manhole and new line sections installed in the project area for cracks, damaged lining, leaks, or abnormal conditions. The line sections will be chosen by the Engineer/Owner at random subsequent to the manhole inspections.
2. The Contractor shall appropriately correct any deficiencies that are found by such visual inspection, as approved by the Engineer. To adequately locate certain deficiencies, the Contractor shall be required to use closed-circuit television inspection and other methods.
3. All costs involved in remobilizing, inspecting, or correcting deficiencies will be considered incidental to the project and shall be the responsibility of the Contractor at no additional cost to the Owner.

H. Repair of PVC Piping: At the option of the Engineer, if PVC piping is found to be defective during the warranty test period and if the Engineer does not approve a method of pipe repair by the Contractor, the Contractor shall remove and replace the faulty pipe in an approved manner at no additional cost to the Owner.

END OF SECTION

SECTION 02820
CHAIN-LINK FENCES AND GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Galvanized steel chain-link fabric.
2. Galvanized steel framework.
3. Grounding and bonding.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: Provide material descriptions, construction details, dimensions of individual components and profiles, and finishes for the products specified in this Section.

B. Product Certificates: Signed by manufacturers of chain-link fences and gates certifying that products furnished comply with requirements.

C. Field Test Reports: Indicate and interpret test results for compliance of chain-link fence and gate grounding and bonding with performance requirements.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.

B. American Society for Testing and Materials (ASTM)

1. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM A392—Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
3. ASTM A780—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
4. ASTM A824—Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence.
5. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
6. ASTM C94—Standard Specification for Ready-Mixed Concrete.
7. ASTM C150/C150M—Standard Specification for Portland Cement.
8. ASTM C387/C387M—Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
9. ASTM F567—Standard Practice for Installation of Chain-Link Fence.
10. ASTM F626—Standard Specification for Fence Fittings.
11. ASTM F900—Standard Specification for Industrial and Commercial Steel Swing Gates.
12. ASTM F1043—Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
13. ASTM F1083—Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
14. ASTM F1184—Standard Specification for Industrial and Commercial Horizontal Slide Gates.
15. ASTM F2200—Standard Specification for Automated Vehicular Gate Construction

C. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2—National Electrical Safety Code (NESC).
2. IEEE 81—Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.

D. Occupational Safety and Health Administration (OSHA)

1. 29 CFR 1910.7—Definition and Requirements for a Nationally Recognized Testing Laboratory.

E. Underwriters Laboratories (UL)

1. UL 325—Standard for Gate System
2. UL 467—Grounding and Bonding Equipment.

1.04 QUALITY ASSURANCE

A. Source Limitations for Chain-Link Fences and Gates: The Contractor shall obtain each color, grade, finish, type, and variety of component for chain-link fences and

gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Delivery, storage, and handling shall be in accordance with the manufacturer's recommendations.

1.06 QUALIFICATIONS

A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

1.07 TESTING REQUIREMENTS

A. Testing Agency Qualifications: A testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: A person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

1.08 PROJECT CONDITIONS

A. Field Measurements: The Contractor shall verify layout information for chain-link fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.

1.09 DEFINITIONS

A. CLFMI: Chain Link Fence Manufacturers Institute.

PART 2 PRODUCTS

2.01 GENERAL (NOT USED)

2.02 CHAIN-LINK FENCE FABRIC

A. Steel Chain-Link Fence Fabric: The Contractor shall provide fabric fabricated in one-piece widths for the fencing height shown on the Drawings. Comply with CLFMI's *Product Manual* and with requirements indicated below:

1. Mesh and Wire Size: 2-inch mesh, 0.192 inch (6 gauge) diameter.

2. Zinc-Coated Fabric: ASTM A392, with zinc coating applied to steel wire mesh fabric after weaving with the following minimum coating weight:

   a. Class 2: Not less than 2 ounces/square foot (oz/sq.ft.) of uncoated wire surface.
   b. Height as indicated in the Drawings.

3. Coat selvage ends of fabric that is metallic coated during the weaving process with manufacturer's standard clear protective coating.

4. Selvage: Twisted at top selvage and knuckled at bottom.

2.03 FENCE FRAMING

A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F1083. Comply with ASTM F1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz/sq.ft. zinc, and the following strength and stiffness requirements:

1. Line, End, Corner, and Pull Posts and Top Rail: In accordance with requirements for Heavy Industrial Fence.

B. Post Brace Rails: Match top rail for coating and strength and stiffness requirements. Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.

C. Top Rails: Fabricate top rail from lengths 21 feet or longer, with wedged-end or fabricated for expansion-type coupling, forming a continuous rail along the top of chain-link fabric.

D. Intermediate Rails: Match top rail for coating and strength and stiffness requirements.

E. Bottom Rails: Match top rail for coating and strength and stiffness requirements.

2.04 TENSION WIRE

A. General: The Contractor shall provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric.

B. Metallic-Coated Steel Wire: 0.177 inch diameter (7 gauge), marcelled tension wire complying with ASTM A824 and the following:

1. Coating: Type II, zinc coated (galvanized) with the following minimum coating weight:

a. Matching chain-link fabric coating weight.

2.05 SWING GATES

A. General: Comply with ASTM F900 for the following swing-gate types:

1. Single gate.
2. Double gate.

B. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1083 and ASTM F1043 for materials and protective coatings. Match gate fabric to that of the fence system.

C. Frames and Bracing: Fabricate members from galvanized steel tubing with outside dimension and weight according to ASTM F900 fence height shown on the Drawings. Welded joints shall be protected by applying zinc-rich paint in accordance with ASTM A780.

D. Frame Corner Construction: As follows:

1. Welded or assembled with corner fittings and 5/16 inch diameter adjustable truss rods for panels 5 feet wide or wider.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F900 for the following gate fabric heights and leaf widths:

1. Gate Fabric Height by Leaf Width: Over 8 feet by over 18 feet but not over 24 feet.
2. Up to 6 feet wide: 3.500-inch O.D. pipe weighing 7.58 lb/ft.

3. Over 6 feet wide and up to 13 feet wide: 4.000-inch O.D. pipe weighing 9.12 lb/ft.
4. Over 13 feet wide and up to 18 feet wide: 6.625-inch O.D. pipe weighing 18.99 lb/ft.
5. Over 18 feet wide: 8.625-inch O.D. pipe weighing 28.58 lb/ft.

F. Hardware: Latches permitting operation from both sides of the gate, hinges, and keepers. Fabricate latches with integral eye openings for padlocking; the padlock shall be accessible from both sides of the gate.

2.06 FITTINGS

The Contractor shall do the following:

A. General: Provide fittings for a complete fence installation, including special fittings for corners. Comply with ASTM F626.
B. Post and Line Caps: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron having a minimum zinc coating of 1.20 oz/sq ft.
C. Provide weathertight closure cap for each post.

1. Provide line post caps with loop to receive or top rail.

D. Rail and Brace Ends: Hot-dip galvanized pressed steel or hot-dip galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.

E. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Hot-dip galvanized pressed steel or round steel tubing not less than 6 inches long.
2. Rail Clamps: Hot-dip galvanized pressed steel. Provide line and corner boulevard clamps for connecting bottom rails in the fence line to line posts.

F. Tension and Brace Bands: Hot-dip galvanized pressed steel.

G. Tension Bars: Hot-dip galvanized steel, length not less than 2 inches shorter than full height of chain-link fabric. Bars for 2-inch mesh shall have a minimum cross section of 3/16-inch by 3/4-inch. Provide one bar for each gate and end post and two for each corner and pull post unless fabric is integrally woven into post.

H. Truss Rod Assemblies: Hot-dip galvanized steel rod and turnbuckle or other means of adjustment. 3/8-inch diameter steel truss rod with a pressed steel

tightener, minimum zinc coating of 1.20 oz/sq ft, assembly capable of withstanding a tension of 2,000 lbs.

I. Tie Wires, Clips, and Fasteners: Provide the following types according to ASTM F626:

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.148 inch diameter (9-gauge) wire; galvanized coating thickness minimum zinc coating thickness of 1.20 oz/sq ft. matching coating thickness of chain-link fence fabric.

2. Power-driven fasteners.

3. Round Wire Hog Rings: Hot-dip galvanized steel for attaching chain-link fabric to horizontal tension wires. Galvanized Steel: 0.148-inch-diameter (9-gauge) wire; minimum zinc coating thickness of 1.20 oz/sq ft.

J. Pipe Sleeves: For posts set into concrete, provide preset hot-dip galvanized steel pipe sleeves complying with ASTM A53/A53M, not less than 6 inches long with inside dimensions not less than 1/2 inch more than the outside dimension of the post and flat steel plate forming bottom closure.

2.07 CAST-IN-PLACE CONCRETE

A. General: The Contractor shall comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C150, aggregates complying with ASTM C33/C33M, and potable water for ready-mixed concrete complying with ASTM C94.

1. Concrete Mixes: Normal-weight concrete with not less than 3,000 psi compressive strength (28 days), 3-inch slump, and 1 inch maximum size aggregate.

C. Materials: Dry-packaged concrete mix complying with ASTM C387 for normal-weight concrete mixed with potable water according to the manufacturer's written instructions.

2.08 FENCE GROUNDING

A. Conductors: Bare, copper solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

B. Connectors and Ground Rods: Listed in UL 467:

1. Connectors for Below-Grade Use: Exothermic welded type.

2. Ground Rods: Copper-clad steel.

a. Size: 5/8 inch by 96 inches.

2.09 HORIZONTAL SLIDE GATES

A. General: Comply with ASTM F1184 Type II for the following slide-gate types:

1. Class 2 – Internal Roller Design.

B. Fence Fabric: Match gate fabric to that of the fence system.

C. Round Steel Pipe: Comply with ASTM F1043, Material Design Group 1A Heavy Industrial Fence Framework, Schedule 40, galvanized-steel pipe complying with ASTM F1083.

D. Frames and Bracing: Fabricate members from galvanized steel tubing or aluminum tubing with outside dimension and weight according to ASTM F1184 Type II and fence height shown on the Drawings and within this Specification. Top horizontal member to be one-piece extruded section having an integral internal track to accommodate truck assemblies. Vertical and horizontal members shall be located no greater than 8 feet apart. The length of back frame support section shall be a minimum of 40% of the opening. Class 2 cantilever slide gates shall comply with the performance deflection criteria listed in ASTM F1184. Gates shall be designed to open or close by applying an initial pull force no greater than 40 lb. Internal truck assemblies designed to handle the forces required for gate size opening and height. Welded joints shall be protected by applying zinc-rich paint in accordance with ASTM A780.

E. Gate Posts: Fabricate members from round galvanized steel pipe with outside dimension and weight according to ASTM F1184 as follows:

1. 4.000-inch O.D. pipe weighing 9.12 lb/ft.

F. Frame Corner Construction: As follows:

1. Welded or assembled with corner fittings and 5/16-inch-diameter adjustable truss rods for panels.

G. Hardware: Internal rollers shall consist of two swivel-type trucks having sealed lubricated ball bearing wheels and a means to ensure that the trucks remain properly aligned in the track during all normal operations of the gate.

2.10 GATE OPERATORS

General: Electrically operated gates and accessories must be manufactured and installed to comply with the safety requirements of ASTM F2200 and UL 325. Comply with NFPA 70. The Contractor shall do the following:

1. Provide a factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote control stations, safety devices, and weatherproof enclosures. Coordinate electrical requirements with the site electrical system.
2. Provide an operator with a design that enables the motor to be removed without disturbing limit-switch adjustment and without affecting the auxiliary emergency operator.
3. Provide the operator with UL-approved components.
4. Provide electronic components with a built-in troubleshooting diagnostic feature.
5. Provide a unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

A. Motor Characteristics

1. Motors shall be sufficient to start, accelerate, and operate connected loads at designated speeds, within the installed environment, with an indicated operating sequence, and without exceeding the nameplate rating or considering service factor. Motors shall comply with NEMA MG 1, and the following:

    a. Voltage, phase: 460V, three-phase.
    b. Horsepower: 2 hp.
    c. Enclosure: Totally enclosed fan cooled (TEFC).
    d. Duty: Continuous duty at an ambient temperature of 105°F and at an altitude of 3,300 feet above sea level.
    e. Service Factor: 1.15 or greater.

B. Gate Operators

1. Gate operators shall be concrete base/pad mounted and as follows:

   a. Hydraulic slide gate operators.
   b. Operator shall be HySecurity Gate Operator Model 222 EX-ST with Smart touch controller or an approved equal.

C. Operation

1. Operation shall be by means of a metal rail passing between a pair of solid metal wheels with polyurethane treads. Operator motors shall be hydraulic, roller type, and the system shall not include belts, gears, pulleys, roller chains, or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 pounds without the drive wheels slipping and without the distortion of supporting arms. The operator shall be capable of handling gates weighing up to 4,000 lb. Gate panel velocity shall not be less than 2.0 feet per second and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The 'soft stop' feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction). The "soft start" feature shall allow the pump to start at zero pressure and then progressively increase the pressure over a period no less than 2 seconds to 1,000 psi.

2. Standard mechanical components shall include as a minimum:

   a. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully brushed 1-1/2-foot bronze bearing surface, acting on arm pivot pins (Item b below).
   b. Arm pivot pins: 3/4 inch-diameter, stainless steel, with integral tabs for ease of removal.
   c. Tension spring: 2-1/2-inch heavy-duty, 800-pound capacity.
   d. Tension adjustment: Finger tightened nut, not requiring the use of tools.
   e. Drive release: Must instantly release tension on both drive wheels and disengage them from contact with drive rail in a single motion, for manual operation.
   f. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.
   g. Electrical enclosure: Oversized, metal, with hinged lid gasketed for protection from intrusion of foreign objects and providing ample space for the addition of accessories.

h. Chassis: 1/4-inch steel base plate, and #10 Ga. sides and back welded and ground smooth.

i. Cover: #16 Ga. galvanized sheet metal with a powder paint finish. All joints welded, tilled, and ground smooth. Finished corners square and true with no visible joints.

j. Finish: Fully zinc-plated then finished with a coat of high gloss powder paint withstanding a 1,000-hour salt spray test.

k. Drive wheels: 8-inch diameter. Metal hub with polyurethane tread.

l. Drive rail: Shall be extruded 6061 to no less than 1/8-foot thick. The drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.

m. Hydraulic hose: Shall be 1/4-inch synthetic, rated to 2,750 psi.

n. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

o. Hose fittings: At manifold shall be quick-disconnect type. Others shall be swivel type.

p. Hydraulic fluid: High-performance type with a viscosity index greater than 375.

q. A 0 to 2,000-psi pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

r. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside to prevent fluid contamination.

3. Minimum standard electrical components:

a. Pump motor: Shall be a 2 hp, three-phase, 460-volt, 56 C, TEFC, continuous duty motor, with a service factor of 1.15, or greater.

b. All components shall have overload protection.

c. Controls: Smart Touch Controller Board with 128K memory containing:

(1) An inherent entrapment sensor.
(2) A built\-in “warn before operate system.”
(3) A built-in timer to close.
(4) A liquid crystal display for the reporting of functions.
(5) 19 programmable output relay options.
(6) An anti-tailgate mode.
(7) Built-in power surge/lightning strike protection.
(8) The capability with optional software of event logging EEPROM for trouble-shooting diagnostics.

(9) An RS232 port for connection to laptop or other computer peripheral and an RS485 connection of master/slave systems.

d. Transformer 75 VA, non-jumpered taps, for all common voltages.

e. Control circuit: 24 VDC.

D. Remote Controls

1. Each gate operator control system shall operate based on discrete signals (OPEN/CLOSE) provided by the vehicle loop detector and the key enter station. See the Drawings for additional requirements on key enter stations.

2. Vehicle Loop Detector:

a. The vehicle loop detector system shall include an automatic closing timer with an adjustable time delay before closing, a timer cut-off switch, and a loop detector designed to hold the gate open until traffic clears. Provide an electronic detector with adjustable detection patterns, adjustable sensitivity, and frequency settings, and a panel indicator light designed to detect the presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. The Contractor shall provide the number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on the Drawings, as recommended in writing by the detection system manufacturer for the function indicated.

b. Loop:

(1) Factory preformed in the size indicated; style saw-cut with epoxy-grouted installation.

E. Obstruction Detection Devices

1. Provide each motorized gate with automatic safety sensor(s). The activation of the sensor(s) causes the operator to immediately function as follows:

a. Action:

(1) Reverse gate in both opening and closing cycles and hold until clear of obstruction.

b. Sensor Edge:

(1) Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using the gate edge transmitter and operator receiver system.
(2) Along the entire gate leaf leading edge.
(3) Along the entire gate leaf trailing edge.

c. Photoelectric/Infrared Sensor:

(1) System designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

F. Limit Switches

1. Limit switches shall be adjustable switches, interlocked with motor controls, and set to automatically stop the gate at fully retracted and fully extended positions.

G. Emergency Release Mechanism

1. The emergency release mechanism shall be a quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design the system so the control circuit power is disconnected during manual operation.

2. Type:

a. Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall examine areas and conditions with the installer present for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed.
2. Verify limits of existing wetlands to be traversed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. The Contractor shall stake locations of fence lines, gates, and terminal posts. Locate all utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments within the proposed fencing and gate layout shown on the Drawings and report any interferences with these structures or utilities to the Engineer before beginning work.

3.03 INSTALLATION, GENERAL

The Contractor shall do the following:

A. General: Install chain-link fencing to comply with ASTM F567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Setting: Set posts in concrete footing. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Verify that the posts are set plumb, aligned, and at the correct height and spacing, and hold the posts in position during placement and finishing operations until the concrete is sufficiently cured.

1. Dimensions and Profile: All posts shall be at least 6 feet tall and shall follow the alignment specified on the Drawings.
2. Exposed Concrete Footings: Extend concrete 2 inches above grade, smooth, and shaped to shed water.

3.04 CHAIN-LINK FENCE INSTALLATION

The Contractor shall do the following:

A. Terminal Posts: Locate terminal end, corner, and gateposts in accordance with ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15º or more.

B. Line Posts: Space line posts uniformly at 10 feet o.c.

C. Post Bracing Assemblies: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at mid-height of fabric on fences with top rail and at two-thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

D. Tension Wire: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120 inch diameter hog rings of the same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric.

1. Bottom Tension Wire: Install tension wire within 6 inches of the bottom of the fabric and tie to each post with not less than the same gauge and type of wire.

E. Top Rail: Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended by the fencing manufacturer.

F. Intermediate Rails: Install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.

G. Bottom Rails: Install, spanning between posts, using fittings and accessories.

H. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180º and attach the other end to chain-link fabric in accordance with ASTM F626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to braces 24 inches o.c.

K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.05 BARBED WIRE INSTALLATION (NOT USED)

3.06 GATE INSTALLATION

A. General: The Contractor shall install gates according to the manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric in the same way as fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.07 GATE OPERATOR INSTALLATION

A. The Contractor shall comply with NFPA 70 and the manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

B. General

1. The Contractor shall install gate operators according to the manufacturer's written instructions, aligned and true to fence line and grade.

C. Excavation for Concrete Bases/Pads

1. The Contractor shall hand-excavate holes for bases/pads in firm, undisturbed soil to dimensions and depths and at locations as required by the gate operator component manufacturer's written instructions and as indicated.

D. Concrete Bases/Pads

1. The Contractor shall provide cast-in-place or precast concrete, at a depth not less than 12 inches, dimensioned and reinforced according to the gate

operator component manufacturer's written instructions and as indicated on the Drawings.

E. Vehicle Loop Detector System

1. The Contractor shall cut grooves in pavement and bury and seal wire loop according to the manufacturer's written instructions. Connect to equipment operated by the detector.

3.08 GROUNDING AND BONDING

The Contractor shall do the following:

A. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.

B. Grounding Method: At each grounding location, drive a ground rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

C. Bonding Method for Gates: Connect bonding jumper between the gate post and gate frame.

D. Connections: Make connections so the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to pre-vent future penetration of moisture to contact surfaces.

3.09 FIELD QUALITY CONTROL

A. Ground-Resistance Testing Agency: The Contractor shall engage a qualified independent testing agency to perform field-quality control testing.

B. Ground-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure ground resistance not less than 2 full days after the last trace of precipitation, without the soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or

other artificial means of reducing natural ground resistance. Perform tests by the two-point method according to IEEE 81.

C. Desired Maximum Grounding Resistance Value: 25 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds desired value, the Contractor shall provide recommendations to reduce ground resistance and a proposal to accomplish the recommended work.

E. Report: The Contractor shall prepare test reports, certified by the testing agency, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.10 ADJUSTING

A. Gate: The Contractor shall adjust the gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout the entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.11 DEMONSTRATION

A. The Contractor shall engage a factory-authorized service representative to train the Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

SECTION 02920
SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all materials, equipment, labor, and work to construct the project in accordance with the Contract Documents. No time extensions shall be given to the Contractor for not establishing a grass or sod cover during the "proper" planting season.

B. This work includes but is not limited to the following items specified in this Section:

1. Placing sod to provide grass as finished ground cover at all unpaved disturbed areas of the site, including the entire areas of the ponds shall be as indicated on the Contract Drawings.
2. Placing seed to provide grass as finished ground cover in areas (not designated to be sodded) that were disturbed by the work. Provide seed and topsoil for all areas not designated to be sodded that have been disturbed or are indicated on the Contract Drawings to be seeded.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, 2017:

1. FDOT Section 162—Prepared Soil Layer.
2. FDOT Section 570—Performance Turf.
3. FDOT Section 981—Turf Materials.
4. FDOT Section 982—Fertilizer.
5. FDOT Section 983—Water for Grassing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver, store, protect, and handle products to the site to prevent damage from wetness and weather conditions.

C. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

D. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.

1.05 MAINTENANCE

A. Maintenance shall be as indicated under Part 3, Execution, of this Section.

1.06 DEFINITIONS

A. Weeds: Weeds include but are not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragqwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.07 REGULATORY REQUIREMENTS

A. The Contractor shall comply with regulatory agencies for fertilizer and herbicide composition.

PART 2 PRODUCTS

2.01 GENERAL (NOT USED)

2.02 MATERIALS

A. Topsoil

1. Top soil shall be supplied and installed in accordance with FDOT Standard Section 162.

B. Fertilizer

1. Fertilizer shall be a complete, commercial-grade mixture of 12-8-8 analysis.
2. Fertilizer shall conform to applicable state laws for the material used.
3. Commercial-grade mixture shall conform to FDOT Standards, Section 982.

C. Mulch

1. Mulch shall conform to FDOT Standards, Section 981.
2. Mulch shall be dry grain straw or hay, free of noxious weeds.
3. Mulch shall be thoroughly cured and dried before use.
4. Forest litter, pine needles, or Spanish Moss will not be acceptable.

D. Seed

1. All grass seed shall be the product of a reputable supplier and shall conform to the requirements of the State Department of Agriculture and Consumer Services and all applicable state laws.
2. Grass seed shall conform to FDOT Standards Section 981, with a minimum 80% purity and 80% germination with no noxious weeds.
3. Seed shall be Argentine Bahia applied at a minimum rate of 10 pounds per 1,000 square feet. A thick stand of grass shall be provided.

E. Sod

1. Sod shall conform to FDOT Standards Section 981. A thick stand of grass shall be provided at all locations.
2. Sod shall be Argentine Bahia.
3. Sod planted on private properties shall match the existing sod when practical.

F. Water

1. The water used to produce grass may be obtained from any approved source, in accordance with FDOT Section 983. The water shall be free of excess and harmful chemicals, acids, alkalies, and all substances which may be harmful to plant growth or obnoxious to traffic. Salt or brackish water shall not be used. The Contractor shall make arrangements to secure and pay for water. The Contractor shall make all provisions necessary to water until a thick stand of grass is established.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. The entire area to be seeded, as shown on the Drawings or required in this Section, shall be covered with a 6-inch layer of muck or suitable topsoil, carefully spread and disked lightly into the existing soil and finished to the grades indicated.

3.02 FERTILIZING

A. Fertilizer shall be applied uniformly on the surface of the ground at a minimum rate as specified in Section 570 of FDOT Specifications. It shall be mixed into the soil with a disk harrow, where practicable, or by hand-raking in areas of limited accessibility. Mixing shall be continued until the fertilizer is uniformly incorporated into the top 3 inches of soil.

3.03 MULCHING

A. After spreading and mixing the fertilizer, the Contractor shall apply approximately 2 inches, loose thickness, of the mulch material uniformly over the grassing area and cut into the soil to produce a loose mulch thickness of 3 to 4 inches, in accordance with Section 570 of FDOT Specifications. Care shall be exercised to prevent the mulch from being cut too deeply into the soil.

3.04 SEEDING

A. Seed which has become wet or moldy shall not be used. Soon after the mulch material has been cut into the soil and while the soil is still loose and moist, the seed shall be scattered uniformly over the grassing area. Application shall be in conformance with FDOT Standards, Section 570.

3.05 SODDING

A. Application shall be in accordance with FDOT Standards, Section 575.

3.06 WEED CONTROL

A. The Contractor shall apply herbicides as required and as recommended by the County Agricultural Agent. Herbicides shall only be applied as needed.

3.07 COMPACTION

A. Immediately after the seeding is complete, the entire grassed or mulched area shall be compacted with a light roller. Rolling shall be continued until the area is firmly but not tightly packed.

3.08 EQUIPMENT

A. All equipment used in the operation of grassing shall be adequate to produce the required results. Equipment for placing mulch material into the soil shall be suitable for cutting the specified materials uniformly into the soil and to the required controlled depth. Rollers shall have corrugated or notched surfaces and shall be at least 12 inches in diameter. Smooth surface rollers will not be permitted.

3.09 GROUND COVER DATA

A. Planting dates, types of seeds, seed mixtures, and rates of application shall be as set forth in this Section. No changes may be made in the ground cover type without the approval of the Engineer.

3.10 GROUND COVER ESTABLISHMENT

A. General Requirements

1. The Contractor shall provide ground cover (sod and seed) establishment of the specified permanent vegetation before final acceptance of the project with no dead areas of ground cover. Groundcover (sod and seed) establishment shall consist of necessary preserving and protecting to keep the grassed areas in a satisfactory condition. The Contractor shall water the grassed areas as long and as often as necessary to promote maximum practicable growth. At any time the Engineer may require replanting an area or portion of an area which, for any cause, shows unsatisfactory growth. Except as otherwise specified or permitted by the Engineer, the Contractor shall prepare areas to be replanted in accordance with the requirements of the Specifications as if such replanting were the initial planting. However, the type of fertilizer and the applicable rate of fertilizer to be furnished and applied by the Contractor as part of plant establishment occasioned by replanting shall be determined by soil tests or otherwise established.

B. Growth and Coverage

1. The Contractor shall be responsible for providing satisfactory growth and coverage as defined below. Growth and coverage shall be considered acceptable when all areas show a satisfactory visible growth with no bare spots larger than 1 square foot. Bare spots shall be scattered and the total bare areas should not comprise more than 1/100 of any given area.

3.11 EXTENT OF SOD/GRASS MAINTENANCE

A. The Contractor is responsible for all sod and grass maintenance until the date of final completion of the project. Sod and grass maintenance includes cutting, watering , fertilizing, re-seeding, and re-sodding as required to maintain the required coverage of healthy, vibrant grass and sod cover.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to design, install, and remove formwork for cast-in-place concrete as shown on the Drawings and as specified in this Section.

B. Secure to forms as required or set for embedment as required all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, and other items furnished under other Sections and required to be cast into concrete or approved in advance by the Engineer.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1. Form release agent.
2. Form ties.
3. Layout of panel joints and tie hole pattern.
4. Proposed method of sealing tie holes and through-bolt holes.

B. Samples

1. 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 finished and will not affect the forming materials.
2. Certify that the form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents

are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.
2. ACI 117—Standard Tolerances for Concrete Construction and Materials.
3. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
4. ACI 347—Guide to Formwork for Concrete.

B. American Plywood Association (APA)

1. Material grades and designations as specified.

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

1.04 QUALIFICATIONS

A. Formwork, falsework, and shoring designer shall be a Florida-licensed Engineer.

1.05 SYSTEM DESCRIPTION

A. General: Architectural Concrete is wall, slab, beam, or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water/waste water-containment structures from the top of walls to 2 feet below the normal water surface in open tanks and basins.

B. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 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.

C. When high range water reducer (superplasticizer) is used in the concrete mix, forms shall be designed for full hydrostatic pressure per ACI 347. Make all joints in forms watertight.

D. Limit panel deflection to L/360 of each component span to achieve tolerances specified.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and model or catalog number is to establish the standard of quality and general configurations desired.

2.02 MATERIALS

A. Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.

B. Wall Forms

1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior-grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group or an equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.
2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging or creating surface patterns.
3. Wall forms for circular structures shall conform to the circular shape of the structure. Straight panels may be substituted for circular forms provided the horizontal width of all panels does not exceed 2 feet, and the angular deflection between panels is no greater than 3.5 degrees per point.

C. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface, and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

D. Column Forms

1. Rectangular columns shall be formed as specified for wall forms. All corners shall have a 3/4-inch chamfer unless otherwise noted on the Drawings.

E. 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 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.

F. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that after removal of the projecting part no metal shall remain within 1-1/2 inches of the face of the concrete. The part of the tie to be removed shall be at least 1/2-inch diameter or be provided with a wood or metal cone at least 1/2-inch diameter and 1-1/2 inches long. Form ties in concrete exposed to view shall be the cone washer type.
2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.
3. Flat bar ties for panel forms, if used, shall have plastic or rubber inserts having a minimum depth of 1-1/2 inches and sufficient dimensions to permit proper patching of the tie hole.
4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.
5. Common wire shall not be used for form ties.
6. Alternate form ties consisting of tapered-through bolts at least 1 inch diameter at the smallest end or through bolts that use a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain the Engineer's acceptance of the system and spacing of ties before ordering or purchasing forming. Clean, fill, and seal the form tie hole with non-shrink cement grout. The Contractor shall be responsible for watertightness of the form ties and any repairs needed.

PART 3 EXECUTION

3.01 GENERAL

A. Forms shall be used for all cast-in-place concrete, including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings.

B. Forms for walls shall have removable panels at the bottom for cleaning, inspection, and joint surface preparation. Forms for walls of considerable height shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, prevent segregation, and prevent the accumulation of hardened concrete on the forms above the fresh concrete.

C. Molding, bevels, or other types of chamfer strips shall be placed to produce blockouts, rustications, or chamfers as shown on the Drawings or as specified in this Section. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4-inch chamfer. 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.

D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.

E. Before form material is reused, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

3.02 FORM TOLERANCES

A. 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:

1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16 inch and forms for plane surfaces shall be such that the concrete will be planed within 3/16 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.

2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.
3. 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.

3.03 FORM PREPARATION

A. Wood forms in contact with the concrete shall be coated with an effective release agent before the forms are installed.

B. Steel 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 used for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

3.04 REMOVAL OF FORMS

A. The Contractor shall be responsible for all damage resulting from removing the forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300, Cast-In-Place Concrete, and the curing compound applied.

3.05 INSPECTION

A. Failure of the forms to comply with the requirements specified in this Section or to produce concrete complying with requirements of this Section shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified in this Section.

B. Furnish only all deformed steel reinforcement required to be entirely built into cast-in-place concrete and concrete masonry unit construction.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Reinforcing steel. Placement drawings shall conform to the recommendations of ACI 315. All reinforcement in a concrete placement shall be included on a single placement drawing or cross referenced to the pertinent main placement drawing. The main drawing shall include the additional reinforcement (around openings, at corners, etc.) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified.
2. Bar bending details. The bars shall be referenced to the same identification marks shown on the placement drawings.
3. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. The Contractor shall submit test reports, in accordance with Section 01330, Submittals and Acceptance, of each of the following items:

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.
2. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement is required.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A184/A184M—Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615/A615M—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A704/A704M—Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
4. ASTM A706/A706M—Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
5. ASTM A767/A767M—Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
6. ASTM A775/A775M—Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
7. ASTM A884/A884M—Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
8. ASTM A934/A934M—Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
9. ASTM A1064/A1064M—Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

B. American Concrete Institute (ACI)

1. ACI 301—Specifications for Structural Concrete.
2. ACI 315—Details and Detailing of Concrete Reinforcement.
3. ACI 318—Building Code Requirements for Reinforced Concrete and Commentary.
4. ACI SP 66—ACI Detailing Manual.

C. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice.

D. American Welding Society (AWS)

1. AWS D1.4—Structural Welding Code-Reinforcing Steel.

1.04 QUALITY ASSURANCE

A. Provide services of a manufacturer's representative, with at least 2 years' experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

B. Provide documentation that all welders are qualified in accordance with AWS D1.4

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

C. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placing Drawings.

D. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be new, of domestic manufacture, and shall comply with the following material specifications.

B. Deformed Concrete Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars.

C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706/A706M.

D. Welded Steel Wire Fabric: ASTM A1064/A1064M. Provide in flat sheets.

E. Welded Deformed Steel Wire Fabric: ASTM A1064/A1064M.

F. Welded Plain Bar Mats: ASTM A704/A704M and ASTM A615/A615M Grade 60 plain bars.

G. Fabricated Deformed Steel Bar Mats: ASTM A184/A184M and ASTM A615/A615M Grade 60 deformed bars.

H. The following alternate materials are allowed:

1. ASTM A615/A615M Grade 60 may be used for ASTM A706/A706M provided the following requirements are satisfied:

a. The actual yield strength of the reinforcing steel based on mill tests shall not exceed the specified yield strength by more than 18,000 psi. Retests shall not exceed this value by more than an additional 3,000 psi.
b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.
c. The carbon equivalency (CE) of bars shall be 0.55 or less.

I. 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. Blocks shall have equal or greater strength than the surrounding concrete.
4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

J. Tie Wire

1. Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire, or stranded wire.

K. Mechanical reinforcing steel butt splices shall be positive connecting taper threaded-type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH, or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with

coupler manufacturer's bar threader to ensure proper taper and thread engagement. Bar couplers shall be torqued to the manufacturer's recommended value.

1. Unless otherwise noted on the Drawings, mechanical tension splices shall be designed to produce a splice strength in tension or compression of not less than 125% of the ASTM-specified minimum yield strength of the rebar.
2. Compression-type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.

L. Fiber Reinforcement

1. Synthetic reinforcing fiber for concrete shall be 100% polypropylene collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic Industries Inc., Chattanooga, TN, Fibermesh or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

2.02 FABRICATION

A. Fabrication of reinforcement shall be in compliance with the CRSI *Manual of Standard Practice*.

B. Bars shall be cold bent. Bars shall not be straightened or re-bent.

C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the ACI 318.

D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded shall have the applicable end(s) saw cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

PART 3 EXECUTION

3.01 INSTALLATION

A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the *CRSI Manual of Standard Practice*. 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 and shall be maintained within the tolerances set forth by ACI:

1. Concrete cast against and permanently exposed to earth: 3 inches.

2. Concrete exposed to soil, water, sewage, sludge and/or weather: 2 inches (including bottom cover of slabs over water or sewage).

3. Concrete not exposed to soil, water, sewage, sludge, and/or weather:

   a. Slabs (top and bottom cover), walls, joists, shells, and folded plate members: 1 inch.
   b. Beams and columns (principal reinforcement, ties, spirals, and stirrups): 1-1/2 inches.

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 in this Section 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. Secure dowels in place before placing concrete.

G. Reinforcing steel bars shall not be field bent, 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 directed 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.

3.03 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 laps in compliance with ACI 318 and as shown in the Drawings. Splices in adjacent bars shall be staggered. Class A splices may be used when 50% or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.

C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125% of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.

D. Install wire fabric in flat sheets as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place if approved by the Engineer. 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.

E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30 bar diameters. Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

3.04 ACCESSORIES

A. Determine, provide, and install 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 in this Section.

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.

3.05 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 ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION

SECTION 03250
CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Standard waterstops: Product data, including catalogue cut, technical data, storage requirements, splicing methods, and conformity to ASTM standards.
2. Premolded joint fillers: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
3. Bond breaker: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
4. Expansion joint dowels: Product data on the complete assembly, including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformity to ASTM standards.
5. Compressible joint filler: Product data, including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
6. Bonding agents: Product data, including catalogue cut, technical data, storage requirements, product life, application requirements, and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system are compatible with each other.
2. Certification that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A675/A675M—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
2. ASTM C881/C881M—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
3. ASTM C920—Specification for Elastomeric Joint Sealants.
4. ASTM C1059/C1059M—Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
5. ASTM D1751—Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
6. ASTM D1752—Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
7. ASTM D994/D994M—Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

B. US Army Corps of Engineers (CRD)

1. CRD C572—Specification for Polyvinylchloride Waterstop.

C. Federal Specifications

1. FS SS-S-210A—Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of the manufacturer's name and model or catalog number is to establish 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. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.

C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than 5 years.

2.02 MATERIALS

A. Waterstops

1. Base seal PVC waterstop: The waterstop shall be made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of the waterstop shall be 1,750 psi. The waterstop shall conform to CRD C572. Waterstops shall be Style 925 for expansion joints, Style 928 for contraction joints, and Style 927 for construction joints by Greenstreak Plastic Products, St. Louis, MO, or equal.
2. Preformed adhesive waterstops: The waterstop shall be a rope-type preformed plastic waterstop meeting the requirements of Federal Specification SS-S-210A. The rope shall have a cross-section of approximately 1 square inch unless otherwise specified or shown on the Drawings. The waterstop shall be Synko-Flex waterstop as manufactured by Synko-Flex Products of Houston, TX, or equal. Primer for the material shall be as recommended by the waterstop manufacturer.

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 shown otherwise on the Drawings.
2. Premolded joint filler sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings: The joint filler shall be asphalt impregnated fiber board conforming 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 which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.
2. Except where tape is specifically called for on the Drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Williams Tilt-up Compound by Williams Distributors Inc.; Silcoseal 77, by SCA Construction Supply Division, Superior Concrete Accessories, or equal.

D. Expansion Joint Dowels

1. Dowels shall be smooth steel conforming to ASTM A675/A675M, Grade 70. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and extends no more than 0.04 inch from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end. Caps shall allow for at least 1-1/2 inches of expansion.

E. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture-insensitive, epoxy-resin material conforming to ASTM C881/C881M, Type II. The bonding agent shall be Sikadur 32 Hi Mod by Sika Corporation of Lyndhurst, NJ; Concressive Liquid (LPL) by Master Builders of Cleveland, OH; or equal. Acrylic may be used if approved by the Engineer.

F. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material used to fill expansion joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68ºF and subsequently recovering at least 20% of its original thickness in the first half hour after unloading. Compressible joint filler shall be Evasote 380 E.S.P, by E Poxy Industries, Inc., Ravena, NY, Sikaflex 1a by Sika, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Standard Waterstops

1. Install waterstops for all joints in water-holding structures, and where indicated on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Splices shall be made by welding and performed in accordance with the manufacturer's written requirements.
2. Horizontal waterstops in slabs shall be clamped in position by the bulkhead (unless previously set in concrete).
3. Waterstops shall be installed so that half of the width will be embedded on each side of the joint. Care shall be exercised to ensure that the waterstop is completely embedded in void-free concrete.
4. Waterstops shall be terminated 3 inches below the exposed top of walls. Expansion joint waterstop center bulbs shall be plugged with foam rubber, 1 inch deep, at the point of termination.

B. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor must be submitted to the Engineer for written approval.
2. Additional or relocated joints should be located where they least impair the strength of the member. In general, locate joints within the middle third of spans of slabs, beams, and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.
3. All joints shall be perpendicular to the main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.
4. Provide sealant grooves for joint sealant, where indicated on the Drawings.
5. At all construction joints and at concrete joints designated on the Drawings to be "roughened," uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side

to side) of approximately 1/4 inch to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding.

6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.
7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

C. Expansion Joints

1. Do not extend through expansion joints, reinforcement, or other embedded metal items that are continuously bonded to concrete on each side of joint.
2. Position pre-molded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.
3. Expansion joints shall be 3/4 inch wide unless otherwise noted on the Drawings.
4. Where indicated on the Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.
5. Provide center-bulb-type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

D. Contraction Joints

1. Provide sealant grooves, sealants, and waterstops at contraction joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab contraction joints in water containment structures and at other locations shown on the Drawings.
2. Contraction joints may be sawed if specifically approved by the Engineer. If contraction joint grooves are sawed, properly time the saw cutting with the time of the concrete set. Start cutting as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking. No reinforcing shall be cut during sawcutting.
3. Extend every other bar of reinforcing steel through contraction joints or as indicated on the Drawings. Where specifically noted on the Drawings,

coat the concrete surface with a bond breaker before placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Sources of cement, pozzolan, and aggregates.

2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.

3. Air entraining admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.

4. Water-reducing admixture. Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.

5. High-range water-reducing admixture (plasticizer). Product data, including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump range, and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use, including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type, and manufacturer of cement. Provide either a. or b. below for each mix proposed:

   a. Standard deviation data for each proposed concrete mix based on statistical records.

b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28-day cylinder strength test results for each mix. Provide results of 7- and 14-day tests if available.

7. Sheet curing material. Product data, including catalogue cut, technical data, and conformity to ASTM standard.

8. Liquid curing compound. Product data, including catalogue cut, technical data, storage requirements, product life, application rate, and conformity to ASTM standards. Identify proposed locations of use.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates—sieve analysis, physical properties, and deleterious substance.
2. Coarse aggregates—sieve analysis, physical properties, and deleterious substances.
3. Cements—chemical analysis and physical properties for each type.
4. Pozzolans—chemical analysis and physical properties.
5. Proposed concrete mixes—compressive strength, slump, and air content.

D. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and with the aggregates.
2. Certify that admixtures are suitable for use in contact with potable water after 30 days of concrete curing.
3. Certify that the curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents

are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C31/C31M—Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
3. ASTM C39/C39M—Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42/C42M—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94/C94M—Standard Specification for Ready-Mixed Concrete.
6. ASTM C143/C143M—Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150/C150M—Standard Specification for Portland Cement.
8. ASTM C171—Standard Specification for Sheet Materials for Curing Concrete.
9. ASTM C173/C173M—Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
10. ASTM C231/C231M—Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260/C260M—Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C309—Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
13. ASTM C494/C494M—Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C618—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C1017/C1017M—Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

B. American Concrete Institute (ACI)

1. ACI 304R—Guide for Measuring, Mixing, Transporting and Placing Concrete.
2. ACI 305R—Hot Weather Concreting.
3. ACI 306.1—Standard Specification for Cold Weather Concreting.
4. ACI 318—Building Code Requirements for Structural Concrete.
5. ACI 350R—Environmental Engineering Concrete Structures.
6. ACI 309R—Guide for Consolidation of Concrete.
7. ACI 301—Specifications for Structural Concrete.

1.04 QUALITY ASSURANCE

A. Reinforced concrete shall comply with ACI 318; the recommendations of ACI 350R; and other stated requirements, codes, and standards. The most stringent requirement of the codes, standards, and this Section shall apply when conflicts exist.

B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.

C. Thirty days before placing concrete, the Contractor shall discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops, and curing. Propose methods of hot and cold weather concreting as required. Before placing any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss with the Engineer the properties and techniques of batching and placing plasticized concrete.

D. If, during the progress of the work, it is impossible to obtain concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to obtain the desired properties. All changes so ordered shall be made at the Contractor's expense.

E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.

F. The Contractor shall furnish testing of the following materials to verify conformity with this Section and the stated ASTM Standards:

1. Fine aggregates for conformity with ASTM C33/C33M—sieve analysis, physical properties, and deleterious substances.
2. Coarse aggregates for conformity with ASTM C33/C33M—sieve analysis, physical properties, and deleterious substances.
3. Cements for conformity with ASTM C150/C150M—chemical analysis and physical properties.
4. Pozzolans for conformity with ASTM C618—chemical analysis and physical properties.
5. Proposed concrete mix designs—compressive strength, slump, and air content.

G. A firm providing field testing and inspection services will be approved by the Owner. The cost of such work, except as specifically stated otherwise, shall be

paid by the Contractor. The following items shall be tested by the Owner to verify conformity with this Section:

1. Concrete placements—compressive strength (cylinders), compressive strength (cores), slump, and air content.
2. Other materials or products that may come under question.

H. All materials incorporated in the work shall conform to accepted samples.

I. The batch plant used shall be currently certified by the National Ready Mixed Concrete Association.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section:

A. Cement: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination and to minimize warehouse set.

B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.

D. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to ensure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

E. Pozzolan: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination.

F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.

G. Liquid Curing Compounds: Store in closed containers.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of the manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance, and manufacturer's service.

2.02 MATERIALS

A. Materials shall comply with this Section and any applicable State or local requirements.

B. Cement: Domestic Portland cement complying with ASTM C150/C150M. Air entraining cements shall not be used. The brand of cement shall be subject to approval by the Engineer and one brand shall be used throughout the Work. The following cement type(s) shall be used:

1. Class A,B,C,D Concrete Type II with the addition of fly ash resulting in C3A being below 5% of total cementitious content, Type III limited to 5% C3A or Type V.

C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33/C33M.

D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33/C33M. Grading requirements shall be as listed in ASTM C33/C33M Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33/C33M Table 3 for severe weathering regions. Size numbers for the concrete mixes shall be as shown in Table 1 in this Section.

E. Combined Aggregate Gradation shall be well graded with fine aggregate in the in the range of 36 to 40% of the total aggregate weight.

F. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.

G. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix, including other admixtures, and shall be suitable for use in contact with potable water after 30 days of concrete curing.

1. Air-Entraining Admixture: The admixture shall comply with ASTM C260/C260M. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
2. Water-Reducing Agent: The admixture shall comply with ASTM C494/C494M, Type A. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494/C494M, Type F, and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with the manufacturer's recommendations.
4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water-reducing or high-range water-reducing admixtures.

H. Pozzolan (Fly Ash) shall be Class F fly ash complying with ASTM C618 except that the Loss on Ignition (LOI) shall be limited to 3% maximum.

I. Sheet Curing Materials. Waterproof paper, polyethylene film, or white burlap polyethylene sheeting all complying with ASTM C171.

J. Liquid Curing Compound. Liquid membrane forming curing compound shall comply with the requirements of ASTM C309, Type 1 D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. The curing compound shall be approved for use in contact with potable water after 30 days according to NSF 61 (non-toxic and free of taste or odor).

2.03 MIXES

A. An independent testing laboratory acceptable to the Owner engaged by and at the expense of the Contractor shall develop mix designs and testing.

B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placeability, durability, strength, appearance, and other required properties. Proportion

ingredients to produce a homogenous mixture that will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.

C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents and be developed by a testing laboratory acceptable to the Engineer and engaged by and at the expense of the Contractor. Mixes based on standard deviation shall be accepted based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7- and 28-day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16% greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.

D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the paragraph above.

E. Entrained air, as measured by ASTM C231/C231M, shall be as shown in Table 1.

1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231/C231M to accurately determine air content, make special note of this requirement in the admixture submittal.

F. Slump of the concrete as measured by ASTM C143/C143M shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10 inches.

G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1
CONCRETE MIX REQUIREMENTS

Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)	Cementitious Content (4)
A	2,500	C150 Type II	C33	57	440 min.
B	3,000	C150 Type II	C33	57	480 min.
C	4,000	C150 Type II	C33	57	560 min.
D	5,000	C150 Type II	C33	57	600 min.

Class	W/C Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range (inches)
A	0.62 max.	--	3.5 to 5	Yes	*	1 to 4
B	0.54 max.	--	3.5 to 5	Yes	*	1 to 3
C	0.44 max.	20 to 25%	3.5 to 5	Yes	*	3 to 5
D	0.40 max.	--	3.5 to 5	Yes	*	3 to 5

NOTES:
(1) Minimum compressive strength in psi at 28 days.
(2) ASTM designation.
(3) Size Number in ASTM C33/C33M.
(4) Cementitious content in lbs/cu yd.
(5) W/C is Water-Cementitious ratio by weight.
(6) AE is percent air-entrainment.
(7) WR is water-reducer admixture.
(8) HRWR is high-range water-reducer admixture
* HRWR used for all walls, beams and columns. HRWR for slabs used at the Contractor's option.

PART 3 EXECUTION

3.01 MEASURING MATERIALS

A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water, and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.

B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94/C94M except as otherwise specified. Scales shall have been certified by the local Weights and Measures official within 1 year of use.

C. Measure the amount of free water in fine aggregates within 0.3% with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as batched on printed batching tickets.

D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks or by an automatic dispenser approved by the manufacturer of the specific admixture.

1. Charge air entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
2. Inject multiple admixtures separately during the batching sequence.

3.02 MIXING AND TRANSPORTING

A. Concrete shall be ready mixed concrete produced by equipment acceptable to the Engineer. No hand mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.

B. Ready mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.

C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed 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.

D. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94/C94M.

E. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.

F. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.

G. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.

H. Furnish a delivery ticket for ready-mixed concrete to the Inspector as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.

I. Temperature and Mixing Time Control

1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40°F.
2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90°F.
3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90°F. If necessary, substitute well-crushed ice for all or part of the mixing water.
4. The maximum time interval between adding mixing water and/or cement to the batch and placing concrete in the forms shall not exceed the values shown in Table 2.

TABLE 2
MAXIMUM TIME TO DISCHARGE OF CONCRETE

Air or Concrete Temperature (whichever is higher)	Maximum Time
85 to 95°F (27 to 32°C)	60 minutes
70 to 85°F (21 to 26°C)	90 minutes
40 to 69°F (5 to 20°C)	90 minutes

J. Where an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 CONCRETE APPEARANCE

A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:

1. The gradation of aggregate.

2. The proportion of fine and coarse aggregate.
3. The percentage of entrained air within the allowable limits.

B. Concrete for the work shall provide a homogeneous structure which, when hardened, will have the required strength, durability, and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10 feet away shall be acceptable to the Owner and Engineer, and at 20 feet shall show no visible defects. The Contractor shall coordinate inspections of the first sections of each type of concrete placed (e.g., walls, beams, columns, slabs) for review and acceptance.

3.04 PLACING AND COMPACTING

A. Placing

1. The Contractor shall verify that all formwork completely encloses concrete to be placed and is securely braced before placing concrete. Remove ice, excess water, dirt, and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can ensure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete that has partially hardened or has been contaminated by foreign materials or on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.

3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.

4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.

5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs, and/or walls) has reached adequate strength.

6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.

7. Slabs

   a. After suitable bulkheads, screeds, and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
   b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.
   c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

   a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottoms of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 6 feet. Place concrete for walls in 12- to 24-inch lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 7 feet and the maximum free fall of concrete shall not exceed 12 feet.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding, or forking so that concrete is thoroughly worked around reinforcement, embedded items, and openings and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to

eliminate air or stone pockets that may cause honeycombing, pitting, or planes of weakness.

2. All concrete shall be placed and compacted with mechanical vibrators. The number, type, and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.

3. A minimum frequency of 7,000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30 inches apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8 inches thick shall be consolidated with vibrating screeds; slabs 8 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.

5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to consolidate the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize, and perfect the surface. The vibrators shall be inserted vertically at regular intervals through the fresh concrete and slightly into the previous lift, if any.

6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:

    a. Frequency returns to normal.
    b. Surface appears liquefied, flattened, and glistening.
    c. Trapped air ceases to rise.
    d. Coarse aggregate has blended into the surface but has not disappeared.

3.05 CURING AND PROTECTION

A. The Contractor shall protect all concrete work against injury from the elements and defacements of any nature during construction operations.

B. Curing Methods

1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:

   a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or by covering with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
   b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.
   c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.

2. Specified applications of curing methods.

   a. Slabs for Water Containment Structures: Water curing only.
   b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing, or liquid membrane curing.
   c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
   d. Horizontal Surfaces that Will Receive Additional Concrete, Coatings, Grout, or Other Material that Requires Bond to the Substrate: Water curing.
   e. Formed Surfaces: None if nonabsorbent forms are left in place 7 days. Water cure if absorbent forms are used. Sheet cured or liquid membrane cured if forms are removed before 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete.
   f. Concrete Joints: Water cured or sheet material cured.

C. Finished surfaces and slabs shall be protected from the direct sunlight to prevent checking and crazing.

D. Cold Weather Concreting:

1. *Cold weather* is defined as a period when the average daily outdoor temperature drops below 40°F for more than 3 successive days. The average daily temperature shall be calculated as the average of the highest and the lowest temperature from midnight to midnight.

2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified in this Section. Temperatures at the concrete placement shall be recorded at 12-hour intervals (minimum).

3. The Contractor shall discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather, including producing, transporting, placing, protecting, curing, and monitoring the temperature of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.

4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.

    a. *Degree-days* are defined as the total number of 24-hour periods multiplied by the average daily air temperature at the surface of the concrete (e.g., 5 days at an average 70°F = 350 degree-days).
    b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50°F as 0°F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.

5. Salt, manure, or other chemicals shall not be used for protection.

6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

E. Hot Weather Concreting

1. *Hot weather* is defined as any combination of high air temperatures, low relative humidity, and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305R, approaching or exceeding 0.2 lb/sq ft/hr).

2. Concrete placed during hot weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 305R and the additional requirements specified in this Section.

   a. Temperature of concrete being placed shall not exceed 90°F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set, or cold joints.
   b. All necessary precautions shall be taken to deliver the concrete promptly, to place the concrete promptly upon its arrival at the job, and to provide vibration immediately after placement.
   c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.

3. The Contractor shall discuss with the Engineer a work plan describing the methods and procedures proposed for concrete placement and curing during hot weather. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

3.06 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 30% of its specified design strength, nor before reaching the following number of degree-days of curing (whichever is longer):

TABLE 3
MINIMUM TIME TO FORM REMOVAL

Forms for:	Degree-Days:
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of *degree-days* in Paragraph 3.05D.)

B. Shores shall not be removed until the concrete has attained at least 75% of its specified design strength and also sufficient strength to support safely its own weight and construction live loads.

3.07 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used with tie-holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment not later than 1 day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish: Provide grout-cleaned finish to scheduled concrete surfaces that have received smooth form finish treatment.

1. Combine one part portland cement to 1-1/2 parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to the consistency of thick paint. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that the final color of dry grout will match adjacent surfaces.
2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

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

3.08 MONOLITHIC SLAB FINISHES

A. Scratch Finish

1. Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
2. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (Fl) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish

1. Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified. Cover slab surfaces with membrane or elastic waterproofing, membrane or elastic roofing, sand-bed terrazzo, or as otherwise indicated.
2. After screening, consolidating, and leveling concrete slabs, do not work the surface until ready for floating. Begin floating using float blades or float shoes only when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate the surface with power-driven floats or by hand-floating if the area is small or inaccessible to power units. Check and level surface plane to tolerances of Ff 18 to Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

C. Trowel Finish

1. Apply a trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin-film-finish coating system.
2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
3. Consolidate the concrete surface by a final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with the surface leveled to tolerances of Ff 20 to Fl 17. Grind smooth surface defects that would telegraph through the applied floor covering system.

D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply the trowel finish as specified, then immediately follow with slightly scarifying the surface by fine brooming.

E. Nonslip Broom Finish

1. Apply nonslip broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
2. Immediately after float finishing, slightly roughen the concrete surface by brooming with a fiber-bristle broom perpendicular to the main traffic route.

F. After completing float finishing and before starting trowel finishing, uniformly spread 25 pounds of dampened nonslip aggregate per 100 square feet of surface. Tamp aggregate flush with the surface using a steel trowel but do not force below the surface. After broadcasting and tamping, apply trowel finishing as herein specified.

G. After curing, lightly work the surface with a steel wire brush or an abrasive stone and water to expose nonslip aggregate.

3.09 INSPECTION AND FIELD TESTING

A. The batching, mixing, transporting, placing, and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours before each concrete placement. The Engineer will inspect the preparations for concreting, including the preparation of previously placed concrete, the reinforcing steel and the alignment, and the cleanliness and tightness of formwork. No placement shall be made without inspection and acceptance by the Engineer.

B. In compliance with ASTM C31/C31M, the Inspector shall take sets of field-control cylinder specimens during the work. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each 150 cu yd of concrete, nor less than one set for each 5,000 sq ft of surface area for slabs or walls.

1. A "set" of test cylinders consists of four cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if the 28-day test results are low.
2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between 7- and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.

C. The Contractor shall cooperate in testing by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations, and furnishing material and labor required for taking concrete cylinder samples. The cost of taking and shipping specimens will be paid for by the Contractor and reimbursed by the Owner under the Concrete Testing Allowance. Curing boxes shall be acceptable to the Engineer.

D. In accordance with ASTM C143/C143M, slump tests will be made in the field immediately before placing the concrete. If the slump is greater than the specified range, the concrete shall be rejected.

E. Air Content: Air content shall be tested for on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be tested for in compliance with either the pressure method complying with ASTM C231/C231M or by the volumetric method complying with ASTM C173/C173M. If lightweight aggregates or aggregates with high absorptions are used, the latter test method shall be used.

F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determining concrete quality. The results of tests on such cores shall be the basis for accepting, rejecting, or determining the continuation of concrete work.

G. 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. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Contractor. Work found to be acceptable will be reimbursed under the Concrete Testing Allowance.

3.10 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer shall have the right to require changes in proportions outlined to apply to 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 which failed. The cost of such additional curing shall be at the Contractor's expense. If 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 replacing those portions of the structure that 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 those specified shall be entirely at the expense of the

Contractor. In such cases of failure to meet strength requirements, the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94/C94M. The "purchaser" referred to in ASTM C94/C94M is the Contractor in this Section.

B. When the tests on control specimens of concrete fall below the specified 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/C42M and ASTM C39/C39M. In the case of cores not indicating adequate strength, 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. Tests need not be conducted until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 60% of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

3.11 PATCHING AND REPAIRS

A. This Section is intended to require quality work, including adequate forming and proper mixing, placing, and curing of concrete so completed concrete surfaces will require no patching.

B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.

C. 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 defects which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete to the approval of the Engineer.

D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100, Concrete Formwork. Promptly fill holes 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 (just short of "balling"). Hammer the grout into the hole until dense and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

E. When patching exposed surfaces, employ the same source of cement and sand as used in the parent concrete. Adjust color if necessary by adding proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days

if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

3.12 SCHEDULE

A. Table 4 lists the general applications for the various concrete classes and design strengths:

TABLE 4
CONCRETE SCHEDULE

Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams, and all other structural concrete
D	5,000	Precast/Prestressed concrete

END OF SECTION

SECTION 03480
PRECAST CONCRETE STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and equipment required to install precast concrete structures as shown on the Drawings and as specified in this Section, including wet wells, circular pump stations, valve vaults, manholes, and accessories. The work shall include the required inlet and outlet pipe connections; frames and covers; special pipe fittings; and all other materials, tools, and equipment necessary to produce complete structures.

B. The Contractor shall furnish Pre-Cast Polymer Manholes and Pump Station Wet Wells in accordance with the Contract Drawings and Section 03490, Polymer Concrete Manholes and Pump Stations.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submittals shall include at least the following:

1. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, and grade rings with notarized certificate indicating compliance with ASTM C478.
2. Location and elevation of all penetrations.
3. Applicable lifting and installation details or instructions.
4. Frames and covers with notarized certificate indicating compliance with specified standards (ASTM A48, Class 30; etc.).
5. Method of repair for minor damage to precast concrete sections.
6. Delivery, unloading, and receiving instructions.

B. Design Data

1. All precast structures shall be designed by an engineer registered in Florida. Calculations and design drawings shall be signed, sealed, and submitted for review before fabrication. Design drawings shall demonstrate that the applicable industry design standards listed in this Section have been met.

2. Precast concrete structures:

a. Sectional plans and elevations showing dimensions and reinforcing steel placement.
b. Structural calculations including assumptions.
c. Concrete design mix.

C. Test Reports

1. Precast concrete structures:

a. Concrete test cylinder reports from an approved testing laboratory certifying conformance with this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A48—Standard Specification for Gray Iron Castings.
2. ASTM A536—Standard Specification for Ductile Iron Castings.
3. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
4. ASTM C14—Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
5. ASTM C33—Standard Specification for Concrete Aggregates.
6. ASTM C150—Standard Specification for Portland Cement.
7. ASTM C207—Standard Specification for Hydrated Lime for Masonry Purposes.
8. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
9. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
10. ASTM C497—Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
11. ASTM C923—Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
12. ASTM C1244—Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

13. ASTM D4101—Standard Specification for Polypropylene Injection and Extrusion Materials.

B. American Concrete Institute (ACI)

1. ACI 318—Building Code Requirements for Structural Concrete and Commentary.
2. ACI 350—Environmental Engineering Concrete Structures.

C. Federal Specifications (FS)

1. FS RR-F-621E—Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.

D. American Association of State Highway and Transportation Officials (AASHTO)

1. Standard Specifications for Highway Bridges.

E. Occupational Safety and Health Administration (OSHA)

1.04 QUALITY ASSURANCE

A. All material shall be new and unused.

B. The quality, manufacturing process, and finished sections of the materials are subject to inspection and approval by the Engineer or other representative of the Owner. Inspection may be at the place of manufacture, at the work site following delivery, or both.

C. Materials may be examined for compliance with ASTM standards, this Section, and approved manufacturer's drawings. Additional inspection criteria shall include appearance, dimensions, blisters, cracks, and soundness. The surface shall be dense and close textured.

D. Materials shall be rejected for failure to meet any requirements specified in this Section. Materials may be rejected at the place of manufacture, at the work site, or following installation. Mark rejected materials for identification and remove them from the work site immediately. Rejected materials shall be replaced at no cost to the Owner.

E. If the Engineer authorizes repair, repair minor damage to precast concrete sections by the approved method. Epoxy mortar may be used for minor repairs subject to the approval of the Engineer.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 QUALIFICATIONS

A. Precast Manufacturer shall have over 3 years of experience producing precast concrete products of type and quality specified. The precast Plant shall have a current PCI certification.

PART 2 PRODUCTS

2.01 GENERAL

A. Precast reinforced concrete structures shall be produced in a plant approved by the Engineer.

B. To provide standardization for appearance, operation, maintenance, spare parts, and manufacturer's service, like items of materials/equipment shall be the end products of one manufacturer.

C. Provide lifting lugs or holes in each precast section for proper handling.

2.02 CONCRETE

A. Concrete and aggregate shall conform to the requirements of Section 03300, Cast-In-Place Concrete, unless otherwise specified in this Section. Portland cement shall be ASTM C150, Type II. Compressive strength shall be not less than 5,000 psi at 28 days. Maximum size of aggregate shall conform to ASTM C33 and shall not exceed one-fifth the narrowest dimension between sides of forms, nor three-quarters the minimum clear spacing between individual reinforcing bars or wires. Water-to-cement ratio shall not exceed 0.45. Slump shall be between 2 and 4 inches, unless otherwise approved by the Engineer. The concrete proportions shall be developed using the same type and brand of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for this project. Accelerators containing calcium chloride shall not be used in precast concrete.

2.03 PRECAST CONCRETE MANHOLES

A. Precast concrete manholes shall conform to the standard specification of ASTM C478.

B. Manhole Bases

1. Manhole bases shall be precast concrete. Their design and fabrication shall conform to the general requirements of this Section and the provisions of ASTM C478. The bases shall conform to the dimensions shown on the Contract Drawings. The horizontal joint at the top of the base shall be compatible with that of the precast wall sections.
2. The precast bases shall be manufactured to contain openings in the wall of minimum size to receive the ends of the pipe. All penetrations shall be cast in at the concrete precast plant. Drilled openings shall not be permitted. These openings shall be accurately set to conform to line and grade of pipe.
3. All precast concrete bases shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, and dimensional distortions or other irregularities. Any units rejected by the Engineer shall be tagged and removed from the job site immediately.

C. Manhole Wall and Top

1. Precast concrete walls shall be made up of straight, circular sections and eccentric tops if manhole steps are required. The total height of precast wall required for each manhole shall be determined in the field and shall be such that the vertical distance between the top of the assembled precast units and the bottom of the installed cast-iron manhole frame is a minimum of 4 inches and a maximum of 12 inches to allow for masonry work or precast concrete grade rings.
2. All precast units shall be laid up plumb and level. Minimum longitudinal and circumferential reinforcing steel shall be in conformance with ASTM C478.
3. All precast concrete sections shall be free from cracks, damaged joints, exposed reinforcing, aggregate pockets, spalls, dimensional distortions, or other irregularities. Any units rejected by the Engineer shall be tagged and removed from the job site immediately.
4. Precast reinforced concrete slab tops for manholes shall be 8 inches thick and manufactured in accordance with ASTM C478. Openings shall be eccentric when manholes are furnished with steps and concentric if they have no steps and of the proper diameter to receive the frame specified. Slab tops shall be set in a full bed of mortar.

D. Manhole Bench Walls

1. The flow channels in each manhole shall be carefully shaped following the details on the Contract Drawings. They shall match the inverts and size of pipes which connect to the manhole, creating a channel of gradual slope and curvature so that a smooth, uninterrupted flow through the manhole is assured. The inverts of these channels shall be constructed of half pipe sections or concrete. For bends, short sections of half pipe may be cut and used to form the channel. Refer to Contract Drawings for details. The bench surface itself shall extend laterally to the manhole walls, pitching slightly toward the flow channel.
2. Minimum concrete Class "C" mix shall be used for bench walls and all exposed surfaces shall receive a steel-troweled finish. Horizontal surfaces shall then be brush finished.

E. Manhole Frames and Covers

1. Frames and covers shall have 24-inch openings and shall be heavy duty, non-penetrating pickhole type of non-rocking design and shall have machined bearing surfaces to prevent rocking and rattling under traffic loads.
2. Material shall be gray cast iron conforming to ASTM A48, Class 30; or shall be ductile cast iron conforming to ASTM A536, Grade 60-40-18.
3. Castings shall be manufactured true to pattern and shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Components shall fit together completely.
4. Covers shall have cast-in, 1-1/2-inch-wide, raised letters with lettering as shown in the Drawings.
5. The finish shall be smooth and well cleaned by shot-blasting or by some other approved method.
6. Frames shall be firmly seated in a full bed of mortar and be positioned to conform to the adjacent finished grade or to the specific elevation shown on the Contract Drawings. Frames shall be set parallel to surface slopes. Covers shall seat uniformly in any position in the frame without rocking.

F. Manhole Steps

1. When shown on the Contract Drawings, manhole steps shall be copolymer polypropylene plastic with 1/2-inch Grade 60 steel reinforcement as manufactured by M.A. Industries, Inc., or equal.
2. Steps are to be cast in or grouted solid into the precast units at intervals of 12 inches. Steps shall be in conformance with OSHA requirements, having drop front or equivalent. Bolted-on types are not acceptable.

2.04 PRECAST WET WELLS AND CIRCULAR PUMP STATIONS

A. Precast sections shall be sized as shown on the Drawings and shall conform to the requirements of ACI 350 and ASTM C478. Precast structures shall meet permeability requirements of ASTM C14.

B. Minimum wall thickness shall be 1/12 the wet well diameter in inches plus 1 inch unless otherwise shown on the Drawings. The top and bottom of all sections shall be parallel (straight sections).

C. Sections shall be cured as specified in Section 03300, Cast-in-Place Concrete, and shall not be shipped until at least 10 days after casting. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the outside of each precast section.

D. All pipe openings and access accessories shall be cast in at the precast plant. Drilled openings shall not be permitted.

E. The wet well shall be designed for the applicable backfill, surcharge, and dead loads. Minimum live load shall be an equivalent lateral fluid pressure of 100 psf per foot of depth. Minimum surcharge live load shall be as stipulated by FDOT H20 highway loading. Design shall include a safety factor of 1.10 against buoyant forces when the weight of soil is excluded, and 1.25 when soil weight directly above the toe is included. The design water table shall be at grade.

F. The base sections shall have the slab integral with sidewalls with slab reinforcing tied to wall steel, unless indicated otherwise on the Drawings. Foundations and lids shall be as detailed on the Drawings.

G. Wetwell and Pump Station Access Covers

1. Access covers shall be furnished by the pump supplier and all embedded items shall be shipped to the precast manufacturer to be cast into the structures. All coordination shall be the Contractor's responsibility. Access covers, access hatches, and accessories shall be as specified in Section 05500, Metal Fabrications, and Section 11535, Submersible Non-Clog Centrifugal Pumps.

2.05 PRECAST VALVE VAULTS

A. Precast vaults shall be sized as shown on the Drawings and shall conform to the requirements of ACI 318. The vaults shall also meet the permeability requirements specified by ASTM C14.

B. The units shall be cured as specified in Section 03300, Cast-In-Place Concrete, and shall not be shipped until at least 10 days after casting. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the outside of each precast section.

C. All pipe openings and access accessories shall be cast in at the precast plant.

D. The manufacturer shall reinforce the vaults to meet all applicable codes. Alternatively, the vaults may be redesigned using the applicable backfill, surcharge, and dead loads. Minimum live load shall be an equivalent lateral fluid pressure of 100 psf per foot of depth. Minimum surcharge live load shall be as stipulated by FDOT H20 highway loading.

E. Access covers shall be as specified in Section 05500, Metal Fabrications.

F. The vault base and lid shall be integral with the sidewalls with slab reinforcing tied to wall steel.

2.06 GRADE RINGS

A. Precast concrete grade rings shall be used to support and adjust manhole frames. Grade rings shall conform to ASTM C478 and shall be set in a full bed of mortar.

2.07 JOINTING PRECAST SECTIONS

A. Seal tongue-and-groove joints of precast manhole sections with either rubber O-ring gaskets or preformed flexible joint sealant. O-ring gaskets shall conform to ASTM C443. Preformed flexible joint sealant shall be Kent Seal No. 2 by Hamilton-Kent, Ram-Nek by Henry, or equal.

B. After the joints are assembled the gap between sections shall be packed on the inside and outside with Anti-Hydro "Axpandaretes," Masterflow 713 by Master Builders or Five Star Grout by US Grout Corp., and shall be troweled smooth so that no projections remain on the inside.

C. The completed joint shall withstand 15-psi internal water pressure without leakage or displacement of gasket or sealant.

2.08 PIPE CONNECTIONS TO MANHOLES

A. Connect pipe to manholes in the following ways:

1. Flexible sleeve—Integrally cast the sleeve in a precast manhole section or install the sleeve in a formed or cored opening. Fasten pipe in sleeve with stainless steel clamp(s). Coat stainless steel clamp(s) with bituminous

material to protect from corrosion. Flexible sleeve shall be Lock Joint Flexible Manhole Sleeve, Kor-N-Seal connector, or equal.

2. Compression gasket—Integrally cast the compression gasket in a precast manhole section. Insert pipe into compression gasket. The compression gasket shall be A-Lok or equal.
3. At the discretion of the Engineer the following procedure may be allowed: Grout in place—Precast manhole sections shall have a formed, tapered circular opening larger than the pipe outside diameter. Grout shall be non-shrink and waterproof equal to Hallemite, Waterplug, or Embeco. Plastic pipe shall have a waterstop gasket secured to the pipe with a stainless-steel clamp before grouting.

2.09 DROP SECTIONS

A. Whenever the invert of a pipe entering a manhole is 24 inches or more in height above the invert of the lowest pipe leaving the manhole, it shall be connected to the manhole with a drop section as shown on the Contract Drawings. The manhole shall be constructed in the normal manner, except that the concrete base shall be extended for outside drop pipes and a straight clean-out pipe shall be connected through the wall as detailed on the Contract Drawings.

B. Fittings and special adapters required for the outside drop section shall be of the same material and class as the pipe entering the manhole. After installing the outside drop section and pipe connections into the manhole, encase the entire vertical, outside assembly in concrete, as shown, using Concrete Class “C” mix.

2.10 DAMPPROOFING

A. Apply two coats of bituminous waterproofing material to the exterior surfaces of precast concrete structures by brush or spray and in accordance with the manufacturer’s recommendations. Dampproofing shall be Hydrocide 648 by Sonneborn Building Products, Dehydratine 4 by A.C. Horn Inc, RIW Marine Liquid by Toch Brothers, or equal.

PART 3 EXECUTION

3.01 PRECAST STRUCTURE INSTALLATION

A. Precast section ends shall be clean of foreign materials and carefully inspected for chips or cracks. Any sections with damaged joint tongue shall not be used. Preformed plastic gaskets and joint sealant shall be installed in strict conformance with the manufacturer's recommendations. Only primer furnished by the gasket manufacturer will be approved.

B. Invert elevations shall be in strict conformance with the Drawings. All sharp edges or rough sections that obstruct flow shall be removed.

C. Access door framing shall be cast in top slabs in methods approved by the Engineer and shall be flush and level with the top of concrete. Reference Section 05500, Metal Fabrications, for additional criteria.

D. Set precast concrete sections vertical and in true alignment. Install O-ring rubber gasket in the recess in the base of previously set section or prime and double seal joint surfaces with "RAM-NEK" premolded plastic joint sealer or Engineer-approved equal.

Completely plug, seal, and smooth all holes in sections used for their handling and the annular space between the wall and entering pipes with non-shrink grout. Finish grout smooth and flush with the adjoining interior and exterior manhole wall surfaces and make watertight.

E. All structures shall be installed plumb.

F. Dampproofing

1. Paint outer surfaces of precast structures with two coats of bituminous dampproofing at the rate of 30 to 60 sq ft per gallon, in accordance with the manufacturer's instructions.

3.02 MANHOLE INSTALLATION

A. Manhole Installation.

1. Manholes shall be constructed to the dimensions shown on the Drawings and as specified in this Section. Protect all work against flooding and flotation.

2. Place the manhole base on a bed of 12-inch crushed stone as shown on the Drawings. Minimum diameter of the stone foundation shall be the outside diameter of the base plus 2 feet. Set the manhole base grade so that a maximum grade adjustment of 12 inches is required to bring the manhole frame and cover to final grade.

a. Use precast concrete grade rings or brick and non-shrink mortar to adjust the manhole frame and cover to final grade.

3. Set precast concrete manhole sections plumb with a 1/4-inch maximum out-of-plumb tolerance allowed. Seal joints of precast barrel sections with

either a rubber O-ring set in a recess or preformed flexible joint sealant in sufficient quantity to fill 75% of the joint cavity. Fill the outside and inside joint with non-shrink mortar and finish flush with the adjoining surfaces. Caulk the inside of any leaking barrel section joint with lead wool or non-shrink grout to the satisfaction of the Engineer.

4. Allow joints to set for 14 hours before backfilling unless the Engineer specifically approves a shorter period.

5. Plug holes in the concrete barrel sections required for handling with a non-shrinking grout or non-shrinking grout in combination with concrete plugs. Finish flush on the inside.

6. The ends of the pipe shall be accurately positioned in the openings and properly secured against movement.

7. Backfill carefully and evenly around manhole sections.

B. Manhole Pipe Connections

1. Construct manhole pipe connections, including pipe stubs, as specified above. Close or seal pipe stubs for future connections with a gasketed watertight plug.

C. Mortar

1. Mix mortar only in such quantity as may be required for immediate use. Use mortar before initial set has taken place. Mortar shall be used within 1-1/2 hours and shall be constantly worked with hoe or shovel until used. Anti-freeze mixtures shall not be included in the mortar. Install masonry when the outside temperature is above 40ºF unless provisions are made to protect the mortar and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The Engineer's decision regarding the adequacy of protection against freezing shall be final.

D. Setting Manhole Frame and Cover

1. Set manhole covers and frames in a full mortar bed so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Precast concrete grade rings a maximum of 12 inches thick shall be used to ensure that the frame and cover are set to the finished grade. Set the manhole frame and

cover to final grade before placing permanent paving. Install curb inlet stones as shown on the Drawings.

2. Set manhole frames and covers flush with finish pavement or 3 inches above the finished grade in unpaved areas. Place a ring of mortar around the outside of the bottom flange at least 1 inch thick and pitched to shed water away from the frame. Extend mortar to the outer edge of the masonry and finish smooth and flush with the top of the flange.

E. Dampproofing

1. Paint outer surfaces of manholes with two coats of bituminous dampproofing at the rate of 30 to 60 sq ft per gallon, in accordance with the manufacturer's instructions.

3.03 LEAKAGE TESTS

A. Test each sewer manhole, pump station, and wetwell for leakage by one of the methods described below. The Engineer shall observe each test.

B. Exfiltration Test

1. Assemble precast structure in place; fill and point all lifting holes and exterior joints within 6 feet of the ground surface with an approved non-shrinking mortar. Test before placing the shelf and invert and before filling and pointing the horizontal joints below 6 feet of depth. Lower the groundwater table below the bottom of the structure for the duration of the test. Plug all pipes and other openings into the precast structures and brace to prevent blow out.
2. Fill the manhole or wetwell with water to the top of the structure. If the excavation has not been backfilled and no water is observed moving down the surface of the structure, the manhole or wetwell is satisfactorily watertight. If the test as described above is unsatisfactory as determined by the Engineer or if the excavation has been backfilled, continue the test. A period of time may be permitted to allow for absorption. Following this period, refill the manhole or wetwell to the top of the structure, if necessary, and wait at least 8 hours. At the end of the test period, refill the manhole or wetwell to the top of the structure again, measuring the volume of water added. Extrapolate the refill amount to a 24-hour leakage rate. The leakage for each manhole or wetwell shall not exceed 1 gallon per vertical foot for a 24-hour period. If the manhole or wetwell fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, the Contractor may make repairs by approved methods as directed by the Engineer. If leakage due to a defective section of joint exceeds

3 gallons per vertical foot per day, the structure shall be rejected. Uncover the rejected structure as necessary to disassemble, reconstruct, or replace it as directed by the Engineer. Retest the manhole or wetwell and, if satisfactory, fill and paint the interior joints.

3. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.

C. An infiltration test may be substituted for an exfiltration test if the groundwater table is above the highest joint in the manhole. If the Engineer determines there is no leakage into the manhole, the manhole will be considered watertight. If the Engineer is not satisfied, the Contractor shall perform an exfiltration or air testing.

D. Vacuum Test

1. Vacuum testing shall conform to ASTM C1244.
2. If the pressure drop exceeds the acceptable limits, the Contractor will be allowed to make necessary repairs, as approved by the Engineer. The manhole shall then be re-tested.
3. When a successful vacuum test has been completed, fill and point the interior and exterior joints.

E. Leakage Tests for Drain Manholes

1. The Engineer will visually inspect drain manholes for possible leaks before backfilling is allowed. All joints shall be sealed to the satisfaction of the Engineer.
2. The Engineer may require an exfiltration test as described for sewer manholes on any structure for which he/she deems such a test appropriate.

3.04 CLEANING

A. The Contractor shall thoroughly clean all precast structures of all silt, debris, and foreign matter of any kind before final inspections.

3.05 PROTECTION AND FIELD QUALITY CONTROL

A. The Contractor shall protect units from chipping, spalling, or other damage after delivery to the site.

B. Owner shall inspect units for chips, cracks, spalled areas, and other damage, and shall record the location and condition of damaged or non-matching units. All recorded damage shall be repaired to the satisfaction of the owner and at no cost to the owner.

END OF SECTION

SECTION 03490
POLYMER CONCRETE MANHOLES AND PUMP STATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified in this Section.

B. This specification covers polymer concrete manholes intended for use in sanitary sewers, storm sewers and water lines where corrosion resistance is required.

1.02 SUBMITTALS

A. Conform to bid document requirements.

B. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, jointing methods, materials, and dimensions.
2. Summary of criteria used in manhole design including, as minimum, material properties, loading criteria, and dimensions assumed. Include certification from manufacturer that polymer concrete manhole design meets or exceeds the load and strength requirements in the documents and of ASTM C478 and ASTM C857, reinforced in accordance with ACI 440.1R-15.
3. Frames, grates, rings, and covers.
4. Materials to be used in fabricating pipe drop connections.
5. Materials to be used for pipe connections.
6. Materials to be used for stubs and stub plugs, if required.
7. Proof of independent chemical resistance testing conducted in accordance with the standard specifications for public works construction (California Greenbook) Section 211-2.
8. Current ISO 9001:2015 Certification.
9. References of 10 previous polymer concrete projects including scope in the last 5 years performed with both owner and contractor for reference and review by owner.

C. Submitted sealed drawings by a registered Professional Engineer in the State of Florida.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C478 (most current) Standard Specification for Precast Reinforced Concrete Manhole Sections.
2. ASTM C579 (most current) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic, Surfacing, and Polymer Concretes.
3. ASTM C443 (most current) Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.
4. ASTM C497 (most current) Test Methods for Concrete Pipe, Manhole Sections, or Tile.
5. ASTM C580 (most current) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithihc Surfacings, and Polymer Concretes.
6. ASTM C857 (most current) Standard Practice for Minimum Structural Design Loading for Underground Utility Structures.
7. ASTM C923 (most current) Standard Specifications for Resilient Connectors between Concrete Manholes Structures and Pipe.
8. ASTM C990 (most current) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants.
9. ASTM D648 (most current) Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position.
10. ASTM D2584 (most current) Test Method for Ignition Loss of Cured Reinforced Resins.
11. ASTM D6783 (most current) Standard Specification for Polymer Concrete Pipe.

B. American Concrete Institute (ACI)

1. ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures & Commentary.
2. ACI 440.1R-15 Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) BarsACI 548.6R-96 Polymer Concrete-Structural Applications State-of-the-Art Report.

C. California Greenbook—Standard Specifications for Public Works Construction Section 211-2.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section:

1. Cement: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination and to minimize warehouse set.
2. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.
3. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen aggregates.
4. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to ensure uniform dispersion of ingredients in admixture solutions which tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.
5. Pozzolan: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination.
6. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
7. Liquid Curing Compounds: Store in closed containers.

PART 2 PRODUCTS

2.01 POLYMER CONCRETE MANHOLES

A. Provide polymer concrete manhole sections, monolithic base sections and related components referencing to ASTM C478. ASTM C478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product.

B. Provide base riser section with monolithic floors, unless shown otherwise.

C. Provide riser sections joined with bell and spigot/ship-lap design seamed with butyl mastic and or rubber gaskets (ASTM C990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure.

D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings. Use various lengths of polymer concrete manhole sections in combination to provide correct height with the fewest joints.

E. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer.

F. Provide tops to support AASHTO HS-20 loading or loads as required and receiving cast iron frame covers or hatches, as indicated on drawings.

2.02 DESIGN CRITERIA

A. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet the intent of ASTM C478 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer.

1. AASHTO HS-20 design and loading called out in drawings applied to manhole cover and transition and base slabs.
2. Polymer manholes will be designed based upon live and dead load criteria in ASTM C857 and ACI 350-06, and as called out on the drawings.
3. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
4. Internal liquid pressure based on unit weight of 63 pcf.
5. Dead load of manhole sections fully supported by polymer concrete manhole base.

2.03 DESIGN

A. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet loading requirements in these plans and of ASTM C478, ASTM C857 and ACI 350-06 as modified for polymer concrete manhole design as follows:

1. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix

design matrix. All sand and aggregate shall be inert in an acidic environment.

2. Reinforcement shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.
3. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness
4. Thermosetting Resin: The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed.
5. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more the 5/8 inch. The under run in height of a riser or cone shall not be more than 1/4 inch/foot of height with a maximum of 1/2 inch in any one section.
6. Marking and Identification: Each manhole shall be marked with the following information – Manufacturer's name or trademark, Manufacturer's location, and Production Date.
7. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or gasketed joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity.
8. Minimum clearance between wall penetrations and joints shall be in accordance with the manufacturer's design.
9. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material.
10. Provide resilient connectors conforming to requirements of ASTM C923 or other options as avaliable. All connectors are to be water tight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

2.04 QUALITY CONTROL

A. Facility Quality Control should be maintained by adhearing to ISO 9001:2015 for manufacturing. All fabricators will be ISO 9001:2015 Certifiied. All fabrication will take place in an all polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility. Fabricator is also to provide references of 10 previous projects in the last 5 years performed with both owner and contractor for reference and the scope and review by owner. Polymer concrete shall be cast in a polymer only facility and shall not be manufactured in a cementitious concrete facility.

2.05 GROUTING

A. All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer.

2.06 MANUFACTURER

A. Polymer concrete manholes shall be manufactured by U.S. Composite Pipe, Inc., a division of Thompson Pipe Group, Armorock, LLC or pre-approved equal.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 03600
GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
2. Commercially manufactured non-shrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300, Cast-In-Place Concrete, and for fiber reinforcement as delineated in Section 03200, Concrete Reinforcement. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.

B. Laboratory Test Reports: Submit laboratory test data as required under Section 03300, Cast-In-Place Concrete, for concrete to be used as concrete grout.

C. Certifications: Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

D. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years' experience in the production and use of the proposed grouts which they will supply.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
2. ASTM C150/C150M—Standard Specification for Portland Cement.
3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
5. ASTM C827/C827M—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
6. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.

B. US Army Corps of Engineers Standard (CRD)

1. CRD C-621—Corps of Engineers Specification for Non-Shrink Grout.

1.04 QUALITY ASSURANCE

A. Pre-installation Conference

1. Well in advance of grouting, the Contractor shall hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.

B. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in installing the products, shall attend the pre-installation conference and shall be present for the initial installation of

each type of nonshrink grout. Additional services shall also be provided as required to correct installation problems.

C. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of Concrete Grout shall be as specified for concrete in Section 03300, Cast-In-Place Concrete.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.

C. Store materials in full compliance with the manufacturer's recommendations. Total storage time from the date of manufacture to the date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

D. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

E. Nonshrink-cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

F. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

1.07 QUALIFICATIONS

A. The grout manufacturer shall have a minimum of 10 years' experience in the production and use of the type of grout proposed for the work.

1.08 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is to establish the standard of quality desired.

B. To standardize appearance, like materials shall be the products of one manufacturer or supplier.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107/C1107M, Grades B or C and CRD C-621. Grouts shall be Portland-cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents, and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827/C827M.

    a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp.; or equal.
    b. Flowable (Precision) non-shrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp.; or equal.

B. Nonshrink Epoxy Grout

1. See Specification Section 03610, Grouting—Non-Shrink Epoxy Machinery Grout.

C. Cement Grout

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150/C150M, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33/C33M with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall conform to the requirements of Section 03300, Cast-In-Place Concrete, except as specified in this Section. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and an air-entraining agent to produce a mix having an average strength of 2,900 psi at 28 days, or 2,500 psi nominal strength. Coarse aggregate size shall be 3/8-inch maximum. Slump should not exceed 5 inches and should be as low as practical yet still retain sufficient workability.
2. Synthetic reinforcing fibers as specified in Section 03200, Concrete Reinforcement, shall be added to the concrete grout mix at the rate of 1.5 lb of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound, free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before installing the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placing of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, using a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. An adhesive bonding agent should only be used in lieu of surface saturation when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leak-proof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION—GENERAL

A. The Contractor shall mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90ºF during grouting and for at least 24 hours after or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90ºF range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or contraction joint.

F. Reflect all existing underlying expansion, contraction, and construction joints through the grout.

3.03 INSTALLATION—CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with the manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3 inches deep shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45º angle from the lower edge of the bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION—NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90ºF.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION—CONCRETE GROUT

A. Follow all instructions on the Drawings and the information contained in this Section. Contractor shall follow the most stringent installation criteria between what is shown on the Drawings and in the Specifications.

B. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.

C. Remove the debris and clean the surface by sweeping and vacuuming all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing debris into tank drain lines will not be permitted.

D. Saturate the concrete surface for at least 24 hours before placing the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placing the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch-thick cement paste.

E. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure that high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.

F. Provide layout of grout contraction joints for approval prior to grouting.

G. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater than 3 feet wide by 3 feet long and, except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.

2. Flowable non-shrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable non-shrink grout for general purpose nonshrink cementitious grout.
3. Non-shrink epoxy grout: Use for setting anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
4. Cement grout: Cement grout may be used for grouting incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when non-shrink grout is specifically called for on the Drawings or for grouting primary structural steel members such as columns and girders.
5. Concrete grout: Use for overlaying the base concrete as shown in Drawings and under scraper mechanisms of clarifiers to allow more control in placing the surface grade. Grout shall be approved by the manufacturer for the specific use.

END OF SECTION

SECTION 03610
GROUTING—NON-SHRINK EPOXY MACHINERY GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section contains the requirements for grouting with non-shrink epoxy machinery grout.

B. The Contractor shall perform all work necessary to prepare metal base and concrete substrate surfaces and to mix, place, and protect non-shrink epoxy machinery grout.

1.02 SUBMITTALS

The Contractor shall submit Shop Drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: Submit the manufacturer's product data and installation instructions/recommendations.

B. Certification: Submit certificates of compliance or laboratory test reports which indicate the following:

1. Materials used in the grout do not contain metallic elements and corrosion-producing substances.
2. Materials meet specified shrinkage and compressive strength requirements.
3. The non-shrink epoxy machinery grout complies with the machinery manufacturer’s (e.g., the high-service pump manufacturer’s) requirements with respect to creep for the particular service application. Creep characteristics shall be based on ASTM C1181/C1181M and long-term data. Coordinated certificates of compliance shall be provided by both the grout manufacturer and the machinery manufacturer.

C. Documentation of Experience Level. Submit evidence that the Contractor’s grouting crew meets the requirements as specified in this Section under Manufacturer and Installer Qualifications.

D. Grouting Plan. The grouting plan shall be reviewed and accepted by the high-service pump manufacturer and by the non-shrink epoxy machinery grout manufacturer before being submitted to the Engineer. This plan shall include grout installation drawings for the machinery to be grouted and shall list, provide

a detailed description of, and present a timeline for all activities necessary to perform the complete work. Activities and items to be addressed shall include but not be limited to the following:

1. Surface preparation:

    a. Curing and developed strength of concrete foundation.
    b. Clean, roughen, and dry concrete surfaces.
    c. Clean metal surfaces for optimum bond.

2. Formwork:

    a. A list of materials to be used for forms, isolation joints, bond prevention, leak prevention/sealant, fasteners to concrete, etc.
    b. A method for forming chamfers and making formwork watertight.
    c. The location and size of base anchor bolts and leveling components. Indicate whether each leveling component is to be retained/encapsulated in the grout. For leveling components to be retained/encapsulated, indicate the minimum rounding radius required on all edges by the grout manufacturer to limit stress concentrations in the grout to acceptable levels and preclude grout cracking.
    d. The location of and protection for all surfaces not to be bonded to the grout.

3. Environmental protection:

    a. Maintain a dry work area.
    b. Shade from sun.

4. Ensure that clearances/dimensional requirements are met for the following:

    a. Isolation joints and the extent of each pour.
    b. Grout shouldering height, width, and chamfer angle.
    c. Air vent holes and grout application holes.
    d. Form height relative to machinery base.

5. Mixing.

6. Placement procedures:

    a. Normal, cold, or hot weather installation procedures, including multiple lifts and isolation joint material removal and subsequent filling.
    b. List equipment to be used and location/set-up during grouting.
    c. Adequate grouting crew for continuous work.

7. Pouring.

8. Finishing.

9. Clean Up.

10. Curing:

    a. Curing and developed strength of the grout.
    b. Anchor bolt torques and when such torques can be applied.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C307—Standard Test Method for Tensile Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.
2. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
3. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
4. ASTM C580—Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
5. ASTM C827/C827M—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
6. ASTM C881/C881M—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
7. ASTM C882/C882M—Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

8. ASTM C1181/C1181M—Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

1.04 QUALITY ASSURANCE

A. The manufacturer of the non-shrink epoxy machinery grout shall have a quality management system in place and shall be ISO 9001 certified. A written Quality Assurance program shall be required to ensure the quality of their products package-to-package and lot-to-lot.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. The warranty period shall be 2 years minimum, commencing on the Date of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Non-shrink epoxy machinery grout shall be delivered and stored in accordance with the manufacturer's recommendations.

C. The Contractor shall not use and shall remove from the job site epoxy grout aggregate that becomes damp or otherwise defective. Liquid components that are found to be defective shall also be removed from the job site.

1.07 QUALIFICATIONS

A. The non-shrink epoxy machinery grout manufacturer shall have been in the business of manufacturing similar products for over 10 years, maintain a strict quality assurance program, offer technical services, and provide a representative at the jobsite for product training before product installation.

B. The Contractor's grouting crew shall be qualified and experienced in working with non-shrink epoxy machinery grout. The grouting crew shall have successfully completed installation of the particular grout to be used at no fewer than two facilities having machinery and associated grouting of comparable size and complexity to that required under this project (e.g., the high-service pumps).

1.08 DEFINITION

A. Non-shrink Epoxy Grout: A high-strength epoxy grout which does not shrink in the plastic state, is dimensionally stable in the hardened state, and bonds permanently to a clean metal machinery base and concrete substrate.

PART 2 PRODUCTS

2.01 GENERAL

A. The non-shrink epoxy machinery grout shall provide a highly effective bearing area, permanently maintain alignment of equipment or machinery, and provide proper load transfer to the foundation.

2.02 NON-SHRINK EPOXY MACHINERY GROUT

A. Epoxy Machinery Grout shall be non-shrink non-metallic type, 100% solids, three-component system consisting of resin, hardener, and aggregate. Grout shall have 0% shrinkage in the plastic form and 0% expansion in the hardened form in accordance with ASTM C827/C827M. Compressive strength shall be 5,000 psi in 24 hours and 12,000 psi in 7 days, in accordance with ASTM C579, Method B.

B. Grout shall be a proven product that can be poured or pumped into place to facilitate placement under the bases to be grouted.

C. Grout working time shall be at least 30 minutes.

D. The grout and the grout manufacturer shall be Five Star® DP Epoxy Grout as manufactured by Five Star Products, Inc., Fairfield, CT.; or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall perform all grouting work in accordance with the non-shrink epoxy machinery grout manufacturer's written instructions/recommendations and preparation and placement procedures to achieve the installation as required by the Drawings and as specified in this Section.

B. The Contractor shall have on hand all Material Safety Data Sheets (MSDS) for products being used. MSDSs shall be quickly accessible before and during placement of grout for reference.

3.02 PREPARATION

A. Machinery Base

1. The Contractor shall clean metal surfaces as recommended by the non-shrink epoxy machinery grout manufacturer.
2. Surfaces that are not to be bonded to the grout, such as base anchor bolts and equipment anchor bolts/screws, shall be coated/protected according to the non-shrink epoxy machinery grout manufacturer's recommendations to prevent adherence of the grout.

B. Concrete

1. Concrete shall have developed acceptable strength as required by the non-shrink epoxy machinery grout manufacturer before any grouting work.

2. Bonding surfaces shall be in accordance with the following:

    a. Laitance shall be removed by chipping.
    b. Surfaces shall be clean and free of loose particles, oil, and grease.
    c. Surfaces shall be clean and dry immediately before grouting.
    d. The Contractor shall follow all other recommendations by the non-shrink epoxy machinery grout manufacturer to achieve proper bonding.

3.03 INSTALLATION

A. Setting and Leveling

1. The Contractor shall use leveling screws, nuts, wedges, or shims according to the machinery manufacturer's instructions to position and level the machinery at its proper height. Whether or not such components are to be retained/encapsulated in the grout shall be as specified in the machinery manufacturer's instructions.
2. Where leveling wedges or shims are to be retained after grouting, these components shall have full contact with and provide proper load transfer to the foundation. Such wedges and shims shall have edges rounded in accordance with the requirements specified in the Grouting Plan portion of this Section.

B. Placement of Grout

1. Grout temperature and surrounding environmental conditions shall be adjusted and controlled in accordance with the non-shrink epoxy machinery grout manufacturer's recommendations.
2. Formwork shall be placed in a manner to avoid entrapment of air and resulting voids. Joints shall be sealed to prevent leakage of non-shrink epoxy machinery grout.
3. All leveling wedges and shims which are to be retained shall be encapsulated with non-shrink epoxy machinery grout in accordance with the non-shrink epoxy machinery grout manufacturer's recommendations.
4. Leveling wedges, shims, and screws which are not to be retained shall be removed and the voids filled with non-shrink epoxy machinery grout.
5. No isolation joint materials shall be retained; all such materials shall be completely removed and the resulting spaces shall be filled with non-shrink epoxy machinery grout.
6. The completed grouting work shall be free of voids and shall provide full contact/bearing of the grout against the machinery base and the concrete substrate surfaces.

3.04 MANUFACTURER'S FIELD SERVICE

A. The manufacturer shall provide field service in accordance with the requirements in Division 1, General Requirements.

B. The high-service pump manufacturer's representative shall have certified that the pump installation is ready for grouting before the pump base grouting can begin. The non-shrink epoxy machinery grout manufacturer's representative shall inspect and approve the work just before grouting, observe the placement of grout, and inspect and approve the completed work to ensure that the approved grouting plan has been followed and a proper grout installation has been provided.

END OF SECTION

SECTION 03810
LEAKAGE TESTING OF WATER-RETAINING STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Water tightness testing of reinforced concrete water retaining structures.

1.02 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 350.1—Tightness Testing of Environmental Engineering Concrete Structures.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide potable water, piping, and equipment required to test concrete structures for leakage.

PART 3 EXECUTION

3.01 GENERAL

A. Hydrostatically test reinforced concrete structures that will contain water to requirements specified below and are free of detectable leaks.

B. Do not start leak testing or cleaning of surfaces until concrete is cured and joint sealants have set and cured a minimum of 14 days.

C. Conduct testing before backfill is placed against walls.

D. Before testing, clean exposed surfaces by thorough hosing, and remove surface laitance and loose matter from walls and slabs. Remove wash water and debris by means other than washing through plant piping.

3.02 TEST PROCEDURE

A. Fill structure to be tested to the normal operating liquid level. Filling rate shall not exceed 4 feet of water per hour and shall be at continuous uniform rate with continuous monitoring.

B. The exterior surface of the tank shall be monitored for flowing leaks. Repair any flowing leaks which occur before continuing filling.

C. The water shall be kept at the test level for at least 3 days before the actual test.

D. Measure the vertical distance to the water surface from a fixed point on the tank above the water surface. Record measurements at 24-hour intervals.

E. A drop of the water surface exceeding 1/20 of 1% of the normal volume of contained liquid will be considered failing.

F. The structure will have also be considered to have failed the test if flowing or seeping water is observed, or if moisture can be transferred to a dry hand from the exterior surface.

G. Independently measure change in water volume due to evaporation and precipitation using a 24-inch-deep white, watertight container not less than 10 square feet of surface area. Position the container to experience environmental conditions similar to the structure being tested. The volume change of the structure shall be corrected based on the water volume change in the sample container.

H. Failing tanks that exhibit no visible signs of leaking or seepage may be permitted to be immediately retested.

I. Failing tanks will be drained, repaired, and retested until the tank has met the test requirements.

3.03 REPAIR METHODS

A. Methods for repairing concrete are described in Section 03930, Modifications and Repair to Concrete.

END OF SECTION

SECTION 03930
MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and cut, remove, repair, or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified in this Section. Work under this Section shall also include bonding new concrete to existing concrete.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit to the Engineer, in accordance with Section 01330, Submittals and Acceptance, a Schedule of Demolition and the detailed methods of demolition to be used at each location.

C. Submit the manufacturer's technical literature on all product brands proposed for use to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.

D. When substitutions for acceptable brands of materials specified in this Section are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the most stringent of the two requirements shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C881/C881M—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
2. ASTM C882/C882M—Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.

3. ASTM D570—Standard Test Method for Water Absorption of Plastics.
4. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
5. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
6. ASTM D732—Standard Test Method for Shear Strength of Plastics by Punch Tool.
7. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
8. ASTM G3—Standard Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing.

1.04 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until the Engineer so authorizes.

B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring and bracing, and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust, and prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown, or specified, line drilling will be required in cutting existing concrete.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years' experience in the manufacture of such products and shall have an ongoing program of training, certifying, and technically supporting the Contractor's personnel.

C. Contractor Qualifications: The Contractor shall complete a program of instruction in the application of the approved manufacturer's material specified in this Section and provide certification from the manufacturer attesting to their training and status as an approved applicator.

D. Furnish a notarized certificate stating that the materials meet the requirements of this Section and have the manufacturer's current printed literature on a specified product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

C. Store and condition the specified product as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall comply with this Section and any state or local regulations.

B. Epoxy Bonding Agent

1. General:

a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free moisture-insensitive epoxy-resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881/C881M, Type II, and the additional requirements specified in this Section.

2. Material

a. Properties of the cured material:

(1) Compressive Strength (ASTM D695): 8,500 psi minimum at 28 days.
(2) Tensile Strength (ASTM D638): 4,000 psi minimum at 14 days.
(3) Flexural Strength (ASTM D790 Modulus of Rupture): 6,300 psi minimum at 14 days.
(4) Shear Strength (ASTM D732): 5,000 psi minimum at 14 days.
(5) Water Absorption (ASTM D570 2-hour boil): 1.0% maximum at 14 days.

(6) Bond Strength (ASTM C882/C882M) Hardened to Plastic: 1,500 psi minimum at 14 days' moist cure.
(7) Effective Shrinkage: Passes Test.
(8) Color: Gray.

3. Approved manufacturers include Sika Corporation, Lyndhurst, NJ, Sikadur 32, Hi Mod; Master Builder's, BASF MasterEmaco ADH 326 (formerly Concresive Liquid LPL epoxy); or equal.

C. Epoxy Paste

1. General:

a. Epoxy Paste shall be a two-component, solvent-free, asbestos-free, moisture-insensitive epoxy-resin material used to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts, and all threads into hardened concrete and shall comply with the requirements of ASTM C881/C881M, Type I, Grade 3 and the additional requirements specified in this Section. It may also be used to patch existing surfaces where the glue line is 1/8 inch or less.

2. Material

a. Properties of the cured material:

(1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
(2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break 0.3% minimum.
(3) Flexural Strength (ASTM D790 Modulus of Rupture): 3,700 psi minimum at 14 days.
(4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.
(5) Water Absorption (ASTM D570): 1.0% maximum at 7 days.
(6) Bond Strength (ASTM C882/C882M): 2,000 psi at 14 days' moist cure.
(7) Color: Concrete grey.

3. Approved manufacturers include:

a. Overhead applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV 31; Master Builders, Inc., Cleveland, OH, MasterBrace 1438 (formerly Concresive 1438); or equal.
b. Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV 32; Master Builders, Inc., Cleveland, OH, MasterBrace 1438 (formerly Concresive 1438); or equal.

D. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout and Polymer Modified mortar are included in Section 03600, Grout.

E. Adhesive-capsule-type anchor system shall be equal to the HVA adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of a polyester or vinylester resin, quartz sand aggregate, and a hardener contained in a separate vial in the capsule.

F. Acrylic Latex Bonding Agent

G. Crack Repair Epoxy Adhesive

1. General:

a. Crack Repair Epoxy Adhesive shall be a two-component, solvent-free, moisture-insensitive epoxy-resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.
b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating approved by the FDA for use in contact with potable water.

2. Material

a. Properties of the cured material:

(1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
(2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break 2 to 5%.
(3) Flexural Strength (ASTM D790 Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection)

(4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.
(5) Water Absorption (ASTM D570 2-hour boil): 1.5% maximum at 7 days.
(6) Bond Strength (ASTM C882/C882M): 2,400 psi at 2 days dry; 2,000 psi at 14 days dry plus 12 days moist.
(7) Effective Shrinkage: Passes Test.

3. Approved manufacturers include:

a. For standard applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod; Master Builders Inc., Cleveland, OH, Masterinject 1380 (formerly Concresive 1380) or equal.
b. For very thin applications: Sika Corporation, Lyndhurst, NJ, Sikadur Hi Mod LV; Master Builders Inc., Cleveland, OH, MasterBrace 1438 (formerly Concresive 1438) or equal.

H. Polymer-Modified Portland Cement Mortar (Vertical and Overhead Surfaces)

1. The polymer-modified Portland cement mortar shall be a two-component, polymer-modified, Portland cement fast-setting, non-sag mortar with a migrating corrosion inhibitor.
2. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives. It shall have a particle size of less than 0.1 micron.
3. Component A shall contain an organic, migrating corrosion inhibitor, which has been independently proven to reduce corrosion in concrete via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be calcium nitrate and shall have a minimum of 7 years of independent field testing to document performance on actual construction projects.
4. Component B shall be a blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and accelerators.
5. The ratio of Component A: Component B shall be 1:5:2 by weight.
6. The polymer-modified Portland cement mortar shall be placeable from 1/8- to 1-1/2-inch depth per lift.
7. Aggregate to extend the polymer-modified Portland cement mortar shall be a minus 1/2- or 3/8-inch clean, well-graded, saturated surface dry material having low absorption and high density in conformance with the manufacturer's requirements.
8. Approved manufacturers include Sika Corporation, Lyndhurst, NJ – Sikatop 123 plus.

I. Polymer-Modified Portland Cement Mortar (Horizontal Surfaces)

1. The polymer-modified Portland cement mortar shall be a two-component, polymer-modified, Portland cement fast-setting, non-sag mortar with a migrating corrosion inhibitor.
2. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives. It shall have a particle size of less than 0.1 micron.
3. Component A shall contain an organic, migrating corrosion inhibitor, which has been independently proven to reduce corrosion in concrete via ASTM G3 (half-cell potential tests). The corrosion inhibitor shall not be calcium nitrate and shall have a minimum of seven tests. The corrosion inhibitor shall not be calcium nitrate and shall have a minimum of 7 years of independent field testing to document performance on actual construction projects.
4. Component B shall be a blend of selected Portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, and accelerators.
5. The ratio of Component A: Component B shall be 1:7:2 by weight.
6. The polymer-modified Portland cement mortar shall be placeable from a 1/8-inch to 1-inch depth per lift.
7. Aggregate to extend the polymer-modified Portland cement mortar shall be a minus 1/2- or 3/8-inch clean, well-graded, saturated surface dry material having low absorption and high density in conformance with the manufacturer's requirements.
8. Approved manufacturers include Sika Corporation, Lyndhurst, NJ, Sikatop 122 plus.

PART 3 EXECUTION

3.01 GENERAL

A. In all cases where concrete is repaired in the vicinity of an expansion joint or contraction joint the repairs shall be made to preserve the isolation between components on either side of the joint.

B. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified before drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

3.02 CONCRETE REMOVAL

A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer shall be done by line drilling at limits followed by chipping or jack hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in-place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings or after obtaining written approval from the Engineer.

B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4 inch.

C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1-inch-deep saw cut on each exposed surface of the existing concrete.

D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.

E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

3.03 CONNECTION SURFACE PREPARATION

A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs, or modifications as shown on the Drawings, specified in this Section, or as directed by the Engineer.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond-inhibiting materials from the surface by dry mechanical means, i.e. sandblasting, grinding, etc., as approved by the Engineer. Be sure the areas are not less than 1/2 inch deep. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.

C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc., as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2 inch. Reinforcing to be saved shall not be damaged during the demolition operation.

D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent, or lapped to new reinforcing as shown on the Drawings and provided with 1-inch minimum cover all around.

E. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified in this Section, or as directed by the Engineer.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16-inch layer of cement and water mixed to the consistency of a heavy paste. Immediately after applying the cement paste, place new concrete or grout mixture as detailed on the Drawings.
2. Method B: After the concrete surface has been roughened and cleaned, apply an epoxy bonding agent at connection surface. The field preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.
3. Method C: Drill a hole 1/4 inch larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just before installing epoxy. The drilled hole shall first be filled with [epoxy paste], then dowels/bolts shall be buttered with paste and inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of 10 bar diameters and smooth bars shall be drilled and set to a depth of 15 bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.
4. Method D: Combination of Methods B and C.
5. Method E: The capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed according to the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar, or other embedment item shall be tipped with a double 45º chamfered point, securely fastened into the chuck of all rotary percussion hammer drill and drilled into the capsule-filled hole. The anchor may be installed in horizontal, vertical, and overhead positions.

3.04 GROUTING

A. Grouting shall be as specified in Section 03600, Grout.

3.05 CRACK REPAIR

A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks according to the manufacturer's recommendations. If cracks are less than 1/16-inch thick they shall be pressure injected.

B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to the surface with crack repair epoxy adhesive according to the manufacturer's recommendations.

3.06 CONCRETE SURFACE REPAIR AND/OR EXPOSED REINFORCING REPAIR

A. All loose, unsound (delaminated), and deteriorated concrete shall be removed by mechanical means.

B. Saw cut the perimeter of unsound (delaminated) concrete to form a rectangle with straight edges to a depth of 3/4 inch or to the top of the reinforcing, whichever is shallower. Do not cut reinforcing unless otherwise noted.

C. Chip concrete substrate to obtain a surface profile with new fractured-aggregate surface.

D. The depth of repair shall be not less than the performance criteria of the specific product used.

E. Where reinforcing steel with active corrosion is encountered, the procedure shall be as follows:

1. Remove all contaminants and rust from exposed reinforcing steel.
2. When half of the diameter of the rebar is exposed, chip out behind the reinforcing steel, 1 inch minimum.
3. The distance chipped behind the rebar shall be equal to or exceed the minimum placement depth of the material to be used or as indicated on the Drawings.
4. Bars shown to remain in place which are found to have lost more than 15% cross-sectional area due to corrosion or which are damaged by the concrete removal process so that their cross-sectional area has been reduced by more than 15% shall be replaced with new bars.

F. Cracks encountered in the substrate in the area of the patch area shall be treated as approved by the Engineer.

G. Substrate may be dry or damp but free of standing water.

H. Remove dust, laitance, and any foreign particles.

I. Spray apply mixed epoxy resin adhesive on the prepared area to receive the Portland cement mortar or concrete in strict compliance with the manufacturer's recommendations.

J. While the adhesive coat is still wet (before it is tack-free to the touch) apply polymer-modified cement. The edges shall be vertical and straight.

K. For applications greater than 1 inch in depth, apply polymer-modified cement in lifts. Score the top lifts of each lift to produce a roughened surface before applying the next lift. Allow the lift to reach final set before proceeding with the next lift. Adhesive coat shall be applied between each lift.

3.07 INSPECTION

A. At the completion of all repairs, the Contractor, Engineer, and Installers of the material used on the repairs shall inspect the work.

END OF SECTION

DIVISION 5

METALS

SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Metal ladders.
2. Ladder safety cages.
3. Metal bollards.
4. Loose bearing and leveling plates.
5. Shelf and relieving angles.
6. Miscellaneous framing and supports.
7. Prefabricated steel building columns.
8. Steel channels for overhead door openings.
9. Stair nosings.
10. Loose steel lintels.
11. Gratings.
12. Access hatches.

B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.02 RELATED WORK

A. Section 03300, Cast-In-Place Concrete, for installing anchor bolts, steel pipe sleeves, wedge-type inserts, and other items indicated to be cast into concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For the following:

1. Non-slip aggregates and non-slip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.

5. Grout.
6. Adhesive systems for anchoring dowels and anchor bolts.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type and finish of extruded nosing.

D. Mill Certificates: Signed by the manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

1.04 WORK SEQUENCE

A. The Contractor shall coordinate the installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the Project site in time for installation.

B. The Contractor shall coordinate the installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to the Project site in time for installation.

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American National Standards Institute (ANSI)

1. ANSI A14.3—Ladders – Fixed – Safety Requirements.
2. ANSI/NAAMM MBG 531—Gratings.

B. American Society for Testing and Materials (ASTM)

1. ASTM A27/A27M—Standard Specification for Steel Castings, Carbon, for General Application.
2. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
3. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
4. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
5. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
6. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
7. ASTM A153/A153M—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
8. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307—Standard Specification for Carbon Steel Bolts. Studs, and Threaded Rod 60,000 PSI Tensile Strength.
10. ASTM A489—Standard Specification for Carbon Steel Eyebolts.
11. ASTM A500/A500M—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
13. ASTM A653/A653M—Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
15. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
16. ASTM A786/A786M—Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
17. ASTM B108/B108M—Standard Specification for Aluminum-Alloy Permanent Mold Castings.
18. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
19. ASTM B221—Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
20. ASTM B633—Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
21. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
22. ASTM D1187/D1187M—Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

23. ASTM E488/E488M—Standard Test Methods for Strength of Anchors in Concrete Elements.
24. ASTM F436/F436M—Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
25. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
26. ASTM F594—Standard Specification for Stainless Steel Nuts.
27. ASTM F836M—Standard Specification for Style 1 Stainless Steel Metric Nuts (Metric).
28. ASTM F879—Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws.
29. ASTM F1554—Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
30. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

C. American Society of Mechanical Engineers (ASME)

1. ASME B18.6.3—Machine Screws and Machine Screw Nuts.
2. ASME B18.6.7M—Metric Machine Screws.
3. ASME B18.2.1—Square and Hex Bolts and Screws, Inch.
4. ASME B18.2.3.8M—Metric Hex Lag Screws.
5. ASME B18.6.1—Wood Screws (Inch Series).
6. ASME B18.22.1—Plain Washers.
7. ASME B18.22M—Metric Plain Washers.
8. ASME B18.21.1—Lock Washers (Inch Series).
9. ASME B18.21.2M—Lock Washers (Metric Series).

D. American Welding Society (AWS)

1. AWS D1.1—Structural Welding Code - Steel.
2. AWS D1.2—Structural Welding Code – Aluminum.
3. AWS D1.3—Structural Welding Code – Sheet Steel.
4. AWS D1.6—Structural Welding Code – Stainless Steel.

E. Environmental Protection Agency (EPA)

1. EPA Method 24—Surface Coatings.

F. Federal Regulations (FR)

1. 40 CFR 59—National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

G. Society for Protection Coatings (SSPC)

1. SSPC-PA1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC-SP6—Commercial Blast Cleaning.
3. SSPC-SP10—Near-White Blast Cleaning.
4. SSPC-Paint 20—Zinc-Rich Primers (Type I, Inorganic, and Type II, Organic).
5. SSPC-Paint 29—Zinc Dust Sacrificial Primer, Performance-Based.
6. SSPC-Zone 1A—Interior, Normally Dry.
7. SSPC-Zone 1B—Exterior, Normally Dry.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, Structural Welding Code—Steel.
2. AWS D1.2, Structural Welding Code—Aluminum.
3. AWS D1.3, Structural Welding Code—Sheet Steel.
4. AWS D1.6, Structural Welding Code—Stainless Steel.

1.07 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 PROJECT REQUIREMENTS

A. Structural Performance of Ladders: The Contractor shall provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3 and meeting the Florida Building Code.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of

components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 90°F, ambient; 180°F, material surfaces.

1.10 PROJECT CONDITIONS

A. Field Measurements: The Contractor shall verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on shop drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 Articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include but are not limited to products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

1. Unless noted otherwise, steel that is not stainless steel shall be galvanized with a G90 coating conforming to ASTM A653/A653M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666, Type 316L.

C. Stainless-Steel Bars and Shapes: ASTM A276/A276M, Type 316L.

D. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

E. Steel Pipe: ASTM A53/A53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.04 ALUMINUM ALLOY PRODUCTS

A. Aluminum Sheet Plates: Conforming to ASTM B209.

B. Aluminum Extrusions: Conforming to ASTM B221.

C. Aluminum Castings: Conforming to ASTM B108/B108M.

2.05 FASTENERS

A. General: For all exterior applications and where fastening aluminum, provide Type 304 stainless-steel fasteners. Provide hot-dipped galvanized fasteners in all other applications in accordance with ASTM A153/A153M unless noted otherwise on the Drawings. Select fasteners for type, grade, and class required.

B. High-Strength Bolts and Nuts: ASTM F3125/F3125M with heavy hex nuts ASTM A563 and hardened carbon-steel washers ASTM F436/F436M.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group A4.

E. Stainless Steel Socket Button and Flat Countersunk Head Cap Screws: ASTM F879.

F. Anchor Bolts: ASTM F 1554, Grade 36.

G. Eyebolts: ASTM A489.

H. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

I. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

J. Wood Screws: Flat head, ASME B18.6.1.

K. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

L. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

M. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining without failure a load equal to four times the load imposed, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized in accordance with ASTM A153/A153M.

N. Post Installed Anchors in Concrete: Anchor bolt assembly with ability to sustain, 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 E488/E488M conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations or Wet Environment: Alloy Group (A4) stainless-steel bolts complying with ASTM F593 (ASTM F738M) and nuts complying with ASTM F594 (ASTM F836M).

3. Current ICC-ES Report indicating acceptance per the International Building Code for anchors at structural applications in cracked concrete.

4. Adhesive anchors shall use Hilti HIT RE-500 SD adhesive system, Simpson Strong-Tie SET-XP epoxy adhesive system, Powers Fasteners PE1000+ adhesive system, or approved equal.

5. Wedge Anchors, Drop-in Anchors, Undercut Anchors, and other Expansion Anchors shall be as called for in the plans and details or required by equipment manufacturer, or approved equal.

   a. Approved manufacturers are Hilti, Simpson Strong-Tie
   b. ITW Ramset/Red Head, or Powers Fasteners.

2.06 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9, Finishes.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 3.5 lb/gal or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Available Products:

   a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
   b. Carboline Company; Carbozinc 621.
   c. ICI Devoe Coatings ; Catha-Coat 313.
   d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
   e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
   f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
   g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1197M.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C1107/C1107M, specifically recommended by the manufacturer for heavy-duty loading applications. Use only after engineer's approval.

G. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by the manufacturer for interior and exterior applications.

2.07 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles, surfaces, and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather so as to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of the type indicated and coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.08 METAL LADDERS

A. General

1. Comply with ANSI A14.3 and the Florida Building Code unless otherwise indicated.
2. Space side-rails 18 inches apart unless otherwise indicated.
3. Support each ladder at top and bottom and not more than 60 inches o.c**.** with welded or bolted brackets made from the same metal as the ladder.

B. Steel Ladders

1. Side-rails: Continuous, 1/2- by-2-1/2-inch steel flat bars, with eased edges.

2. Rungs: 3/4-inch-diameter steel bars.

3. Fit rungs in centerline of side-rails; plug-weld and grind smooth on outer rail faces.

4. Provide non-slip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

5. Provide non-slip surfaces on top of each rung by coating with abrasive material metallically bonded to the rung by a proprietary process.

6. Available Products:

a. IKG Industries, a Harsco company; Mebac.
b. W.S. Molnar Company; SlipNOT.

7. Prime exterior ladders and interior ladders, where indicated, including brackets and fasteners, with zinc-rich primer.

2.09 LADDER SAFETY CAGES

A. General

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.

B. Steel Ladder Safety Cages

1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.
4. Where indicated, prime exterior ladder cages and interior ladder cages, including fasteners, with zinc-rich primer.

2.10 METAL BOLLARDS

A. Steel Pipe Bollards: Fabricate pipe bollards from Schedule 80 steel pipe. Fill bollards with concrete.

1. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

B. Fabricate bollards with 1/2-inch-thick steel base plates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.12 GRATINGS

Design floor gratings to withstand a live load of 200 pounds per square foot for the span indicated, with a maximum deflection of L/240.

A. Gray Cast Iron-Gratings: Conforming to ASTM A48/A48M.

B. Metal Plank Gratings: Non-slip type, aluminum conforming to ASTM B209, 6061 T6, and steel conforming to ASTM A653/A653M, G90 galvanized.

C. Metal Bar Gratings: Conforming to ANSI/NAAMM MBG 531.

2.13 PATTERNED FLOOR PLATES

Design floor plates to withstand a live load of 250 pounds per square foot for the span indicated, with a maximum deflection of L/240.

A. Steel Floor Plates: Conforming to ASTM A786/A786M, minimum 14 gauge, and with G90 galvanized coating.

B. Aluminum Floor Plate: Conforming to ASTM B209, 6061 T6.

2.14 ACCESS HATCHES

A. Access hatches shall have single- or double-leaf doors as indicated in the design drawing. The door shall be 1/4-inch aluminum diamond pattern plate with welded stiffeners able to withstand a live load of 300 pounds per square foot with a maximum deflection of L/240. The hatch shall have a ¼-inch aluminum channel frame with perimeter anchor flange or strap anchors for concrete embedment. Hardware shall be of stainless steel throughout. Provide removable lock handle. Hatch shall be watertight and have a 1-1/2-inch drainage coupling to the channel frame.

2.15 MISCELLANEOUS METAL FABRICATIONS

A. Loose Bearing and Leveling Plates: Flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

B. Shelf and Relieving Angles:

1. Fabricate from steel angles of sizes indicated and for attachment to concrete framing. Provide slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 24 inches o.c., unless otherwise indicated.
2. For cavity walls, provide vertical channel brackets to support shelf/relieving angles from back-up masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity wall exterior wythe.
3. Galvanize shelf angles.
4. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete or masonry.

C. Miscellaneous Framing and Supports:

1. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
2. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
3. Galvanize miscellaneous framing and supports in all locations.

D. Steel Channels for Overhead Door Openings

1. Fabricate steel door frame channels from structural shapes of size and to dimensions indicated, fully welded together.
2. Galvanize frames and anchors in all locations.

E. Cast-Metal Nosings:

1. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with an integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.

a. Cast units with an integral abrasive grit consisting of silicon carbide.

2. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.

3. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.

F. Corner Guards: Stainless steel; Thickness: Minimum 1/16 inch.

2.16 FINISHES, GENERAL

A. Comply with NAAMM's *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.17 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A123/A123M, for galvanizing steel and iron products.
2. ASTM A153/A153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 10 "Near White Metal Blast Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete,

sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, *Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel*, for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.18 STAINLESS STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Dull Satin Finish: No. 6.

C. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with anchor bolts. Provide four 3/4-inch bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches in concrete.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with non-shrink, nonmetallic grout mixed and placed to comply with the grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above the bottom of the excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until the concrete has cured.

D. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with non-shrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.

E. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above the bottom of the excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

F. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. The Owner will furnish padlocks.

G. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. The Contractor shall clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if they are protruding cut off flush with the edge of the bearing plate before packing with grout.

1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

The Contractor shall do the following:

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9, Finishes.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION

SECTION 05520
METAL HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Vinyl-coated steel pipe handrails and railings.
2. Stainless-steel pipe handrails and railings.
3. Aluminum pipe handrails and railings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

B. Welder certificates signed by the Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include a list of completed projects with project name, addresses, names of Engineers and Owner, and other information specified.

D. Shop drawings shall indicate loading requirements as specified in this Section and be signed and sealed by a Registered Structural Engineer to be in conformance with all requirements as specified in this Section and in accordance with all State and local codes and regulations.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents

are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Aluminum Association (AA)

1. AA-M12-C22-A41—Clear Class 1 Anodized.
2. AA-M32-C22-A41—Stainless Steel, Type 304.

B. American Iron and Steel Institute (AISI)

1. AISI 316—Stainless Ball Bearings – Corrosion Resistant Bearings.

C. American Society for Testing of Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
4. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
5. ASTM A312/A312M—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
6. ASTM A554—Standard Specification for Welded Stainless Steel Mechanical Tubing.
7. ASTM A743/A743M—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

D. American Welding Society (AWS)

1. AWS D1.1—Structural Welding Code – Steel.
2. AWS D1.2—Structural Welding Code – Aluminum.
3. AWS D1.6—Structural Welding Code – Stainless Steel.

E. Federal Specifications (FS)

1. FS FF-S-325—Shield, Expansion; Nail Expansion, and Nail, Drive Screw (Devices, Anchoring, Masonry).
2. FS FF-B-588—Toggle Bolts.

F. National Fire Protection Association (NFPA)

1. NFPA 101—Life Safety Code.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Select a firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code – Steel," AWS D1.6, "Structural Welding Code – Stainless Steel" and AWS D1.2 "Structural Welding Code – Aluminum."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

C. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete or built into masonry for installing stair work. Coordinate templates for installing anchorage devices.

1. See Section 03300, Cast-In-Place Concrete, for installation of inserts and anchorage devices.

D. Shop Assembly: Pre-assemble items in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Mark units for re-assembly and coordinated installation.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 PROJECT REQUIREMENTS

A. Design, engineer, and provide railings to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections:

1. Handrails: 200 pounds, concentrated load applied at any point in any direction and 50 pounds per linear foot applied in any direction.

2. Guardrails:

a. 200 pounds, concentrated load applied at any point in any direction along the top.
b. 50 pounds per linear foot applied in any direction along the top.
c. 50 pounds, concentrated load applied on a 1-foot area at any point in the system.

3. Loading conditions need not be assumed to act concurrently, but each shall be applied to produce the maximum stress in each respective component or any of the supporting components.

B. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 40ºF, ambient; 120ºF, material surfaces.

1.08 CODES AND REGULATIONS

A. Handrails and railings shall conform to the *Accessibility Requirements Manual* from the Florida Department of Community Affairs, Florida Board of Building Codes and Standards.

B. Handrails and railings shall conform to NFPA 101, Life Safety Code.

C. Handrails and railings shall conform to Occupational Safety and Health Administration (OSHA) Regulations.

PART 2 PRODUCTS

2.01 STEEL PIPE HANDRAILS AND ACCESSORIES (NOT USED)

2.02 STAINLESS STEEL PIPE HANDRAILS AND ACCESSORIES

A. Tubing: ASTM A554, Grade MT 316L.
B. Pipe: ASTM A312/A312M, Grade TP 316L.
C. Castings: ASTM A743/A743M, Grade CF 8M or CF 3M.
D. Fasteners: AISI 316 stainless-steel.

2.03 ALUMINUM PIPE HANDRAILS AND ACCESSORIES

A. Handrail and railing systems shall comply with the requirements of OSHA and FBC.

B. Aluminum railing and handrail shall be a welded or mechanically fastened, seamless, extruded-aluminum pipe system. Rails, posts, and formed elbows shall be 6061-T6or 6063-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc., shall be aluminum alloy 6063-T6or 6061-T6. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be AISI 316 stainless steel. Aluminum shall have a mill finish. After welding, aluminum shall be anodized. All railing, posts, toeboards, and exposed aluminum shall be anodized with an architectural Class I satin finish providing a minimum coating thickness of 0.7 mils and a minimum coating weight of 32 milligrams per square inch in compliance with AA-M32-C22-A41.

C. Railing shall be two-rail welded railing systems, as shown on the Drawings, fabricated with 1-1/2-inch nominal diameter pipe. Posts shall be Schedule 80 pipe minimum and rails and handrail shall be Schedule 40 pipe minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5 feet on center and shall be uniformly spaced except as otherwise shown on the Drawings. Posts will be required on each side of structure expansion joints. All railing posts shall be vertical.

D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rail-to-post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges, or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding areas shall be cleaned and hand-buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion

of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.

E. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.

1. Where non-removable railing is set in concrete, the posts shall be placed in 2-1/2-inch-diameter formed concrete openings and firmly caulked with a nonsulphur compound, hydraulic cement equal to Por-Rok by Minwax Construction Products Division Sterling Drug, Montvale, NJ. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4 inches from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.
2. Stainless steel and aluminum railing posts, which may collect condensation, shall have a 3/16-inch drain hole drilled immediately above the concrete encased area, the base flange, or supporting socket on the side away from the walking area. The bottom of the rail post between the drain hole and the bottom of the post shall be filled with an inert material such as a compressed closed-cell neoprene rod.
3. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with three 3/8-inch stainless-steel flat head machine screws.

F. All handrails shall be capable of withstanding a load of 200 pounds, minimum, applied in any direction at any point on the top rail. In addition, the handrail shall be capable of supporting a lateral load of 50 pounds per foot applied horizontally to the top railing. Handrails shall meet the minimum requirements of all national, state, and local standards, regulations, and code requirements, including OSHA.

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

H. Barrier chains for railing openings shall be fabricated of stainless-steel chains. Chain shall be 1/4-inch stainless-steel links, with 11 links per foot as manufactured by Eastern Chain Works, Inc., NY; Lawrence Metal Products, Inc., or equal. Chains shall be fastened to the handrail posts at the elevation of each rail. One end of each chain shall be connected to one post with a 1/4-inch-diameter stainless-steel eye bolt and the other end shall be connected to the other post by a heavy chromium-plated bronze swivel eye slide harness snap and a similar eye bolt.

I. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4 feet or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs 4 inches or more in height are present. Toeboards shall be 4-inch-high channels of the same material as the railing. The channels shall have a minimum thickness of 1/8-inch and have flanges of not less than 3/4-inch or more than 1-1/2-inch in width. Toeboards shall be positioned with a maximum clearance of 1/4-inch from the floor and fastened to railing posts with 1/4-inch stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-inch stainless steel expansion bolts at walls.

J. All railings shall be properly protected by paper or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.

K. Handrails and accessories shall be as manufactured by Thompson Fabricating Co. or approved equal.

2.04 FABRICATION

A. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.

1. At tee and cross intersections, provide coped joints.
2. At bends, interconnect pipe by prefabricated elbow fittings or flush radius bends, as applicable, of radiuses indicated.
3. Form bends by use of prefabricated elbow fittings and radius bends or by bending pipe at the fabricator’s option.

B. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain the cylindrical cross-section of pipe throughout the entire bend without buckling, twisting, or otherwise deforming exposed surfaces of pipe.

C. Provide wall returns at the ends of wall-mounted handrails, except where otherwise indicated.

D. Close exposed ends of pipe by welding 3/16-inch-thick plate in place or by use of prefabricated fittings.

E. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of railings and handrails to other work. Furnish inserts and other

anchorage devices for connecting railings and handrails to concrete or masonry work.

1. For railings posts set in concrete, provide sleeves of galvanized steel pipe not less than 6 inches long and with an inside diameter not less than 1/2 inch greater than the outside diameter of pipe. Provide steel plate closure welded to the bottom of the sleeve and of width and length not less than 1 inch greater than the outside diameter of the sleeve.
2. Provide friction fit, removable covers designed to keep sleeves clean and hold the top edge of the sleeve 1/2 inch below the finished surface of concrete.

F. Removable sections shall be fabricated of matching pipe, rail material, and configuration.

PART 3 EXECUTION

3.01 INSTALLING HANDRAILS

A. Railing shall be assembled in sections as long as practical but shall not be greater than 24 feet in length. Use a field splice when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure-expansion joints.

1. Field splices shall use internal splice sleeves located within 8 inches of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on the other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.
2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on the other side. The field splice shall be detailed to take the same movement as the structure expansion joint.

B. Secure handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2-inch clearance from the inside face of the handrail and finished wall surface. Locate brackets as indicated. If not indicated, locate brackets at the spacing required for design loading. Secure wall brackets and wall return fittings to building construction as follows:

1. Use bracket with predrilled hole for exposed bolt anchorage.
2. For concrete and solid masonry anchorage, use drilled-in expansion shield and either concealed hanger bolt or exposed lag bolt, as applicable.
3. For hollow masonry anchorage, use toggle bolts having square heads.

3.02 INSTALLATION OF RAILINGS

A. Adjust railings before anchoring to ensure matching alignment at abutting joints. Install posts at spacing indicated. If not indicated, install posts as required by design loadings. Plumb posts in each direction. Secure posts and railings ends to building construction as follows:

1. Anchor posts in concrete by pipe sleeves preset and anchored into concrete. After the posts have been inserted into the sleeves, fill annular space between post and sleeve solid with nonshrink grout.

    a. Leave anchorage joint exposed; wipe off excess grout, and leave 1/8-inch build-up, sloped away from the post. For installation exposed on exterior or to flow of water, seal grout to comply with the grout manufacturer's directions.

2. Anchor posts with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to supporting members.

3. Anchor rail ends into concrete and masonry with round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.

4. Anchor rail ends to metal with oval or round flanges welded to rail ends and bolted to structural metal members, unless otherwise indicated.

5. Isolate railings when they are mounted to dissimilar materials.

3.03 FIELD SPLICES

A. Splices shall be butted and reinforced by a tight-fitting dowel or sleeve not less than 6 inches in length. Center fitting dowels or sleeves to the splice joint. Tack weld or epoxy cement dowel or sleeve to one side of the splice.

B. Place field splices within 8 inches of railing posts.

3.04 REMOVABLE RAILING SECTIONS

A. Provide removable railing sections as indicated. Safety gates shall be self-closing gates with approved stop, latch, and stainless-steel closure spring and hinges.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09900
PAINTING AND COATING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes materials for and application of painting and coating systems for the following surfaces:

1. Submerged metal.
2. Exposed metal.
3. Buried metal.
4. Submerged concrete and masonry.
5. Exposed concrete and masonry.
6. PVC, CPVC, and FRP.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit manufacturer's data sheets showing the following information:

1. Percent solids by volume (sbv).
2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
3. Recommended surface preparation.
4. Recommended thinners.
5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
6. Application instructions including recommended equipment and temperature limitations.
7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

E. Submit material safety data sheets for each coating.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 2604—Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. American Association of State Highway and Transportation Officials (AASHTO)

1. AASHTO T-259—Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration.

C. American Society for Testing and Materials (ASTM)

1. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
2. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM C67/C67M—Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
4. ASTM C97/C97M—Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
5. ASTM C140/C140M—Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
6. ASTM C307—Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
7. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
8. ASTM C518—Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Apparatus.
9. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
10. ASTM C580—Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concrete.
11. ASTM C793—Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.

12. ASTM D520—Standard Specification for Zinc Dust Pigment.
13. ASTM D522/D522M—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
14. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
15. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
16. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
17. ASTM D870—Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
18. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
19. ASTM D1014—Standard Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates.
20. ASTM D1308—Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
21. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness.
22. ASTM D2370—Standard Test Method for Tensile Properties of Organic Coatings.
23. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
24. ASTM D2794—Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
25. ASTM D3273—Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
26. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
27. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
28. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
29. ASTM D4141/D4141M—Standard Practice for Conducting Black Box and Solar Concentrating Exposures of Coatings.
30. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
31. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.
32. ASTM D4261—Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.
33. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

34. ASTM D4541—Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
35. ASTM D4585/D4585M—Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
36. ASTM D4587—Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
37. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
38. ASTM D5590—Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay.
39. ASTM D5894—Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog-Dry Cabinet and a UV/Condensation Cabinet).
40. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
41. ASTM D6695—Standard Practice for Xenon-Arc Exposures of Paint and Related Coatings.
42. ASTM D6904—Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry.
43. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
44. ASTM D7234—Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
45. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
46. ASTM F1869—Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
47. ASTM G210—Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus.

D. American Water Works Association (AWWA)

1. AWWA C203—Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied.
2. AWWA C209—Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings.

E. British Standards Institution (BSI)

1. BS EN 598—Ductile Iron Pipes, Fittings, Accessories, and their Joints for Sewerage Applications – Requirements and Test Methods.

F. National Association of Corrosion Engineers International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
2. NACE TM0174—Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials on Metallic Substrates in Immersion Service.

G. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

H. Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE)

1. SSPC PA-1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC PA-2—Procedure for Determining Conformance to Dry Coating Thickness Requirements.
3. SSPC SP-1—Solvent Cleaning.
4. SSPC SP-2—Hand Tool Cleaning.
5. SSPC SP-3—Power Tool Cleaning.
6. SSPC SP-5/NACE No. 1—White Metal Blast Cleaning.
7. SSPC SP-6/NACE No. 3—Commercial Blast Cleaning.
8. SSPC SP-7/NACE No. 4—Brush-Off Blast Cleaning.
9. SSPC SP-8—Pickling.
10. SSPC SP-10/NACE No. 2—Near-White Blast Cleaning.
11. SSPC SP-11—Power Tool Cleaning to Bare Metal.
12. SSPC SP-12/NACE No. 5—High- and Ultra-High-Pressure Water Jetting.
13. SSPC SP-13/NACE No. 6—Surface Preparation of Concrete.
    a. ICRI CSP1-6—Concrete Surface Profile 1 – 6.
14. SSPC SP-14/NACE No. 8—Industrial Blast Cleaning.
15. SSPC SP WJ-1—Waterjet Cleaning of Metals – Clean to Bare Substrate.
16. SSPC SP WJ-2—Waterjet Cleaning of Metals – Very Thorough Cleaning.
17. SSPC SP WJ-3—Waterjet Cleaning of Metals – Thorough Cleaning.
18. SSPC SP WJ-4—Waterjet Cleaning of Metals – Light Cleaning.

I. US Department of Defense (MIL)

1. MIL-C-5541—Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
2. MIL-C-18480B—Coating Compound, Bituminous, Solvent, Coal-Tar Base.
3. MIL-D-3134—Deck Covering Materials.
4. MIL-DTL-24441—General Specification for Paint, Epoxy-Polyamide.
5. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair.

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Submerged Metal Coating Systems		
2.	Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments	Zinc+MIO blend urethane/Cycloaliphatic amine epoxy
5.	Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage, or Grit Slurries	Epoxy ceramic
Exterior/UV-Exposed Metal Coating Systems		
12.	Exposed Metal, Non-Immersion Environment	Epoxy/epoxy/aliphatic acrylic urethane
13.	Exposed Metal, Mild Environment, Exposed to Atmospheric Weathering and Water Condensation	Zinc+MIO blend/acrylic/acrylic
14.	Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up	Zinc-rich urethane
Buried Metal Coating Systems		
21.	Buried Metal, Standard Pipe Coating System (Suitable for Buried and Aboveground)	Epoxy/epoxy/epoxy
24.	Buried Metal Piping and Tubing	Coal tar, wax, and polyethylene tape wrap or extruded polyethylene
Submerged Concrete and Masonry Coating Systems		
31.	Anaerobic Severe Wastewater Environments with Elevated H_2S Levels, Raw Water (Nonpotable), Raw Sewage, or Chemical Waste Immersion	Modified aliphatic amine epoxy mortar/modified polyamine epoxy

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
32.	Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment	Cycloaliphatic amine epoxy primer, intermediate, and finish
Exterior/UV-Exposed Concrete and Masonry Coating Systems		
41.	New or Bare Concrete and Masonry, Atmospheric Weathering Environment	Modified waterborne acrylate/modified waterborne acrylate
45.	Exposed Masonry or Concrete, Atmospheric Weathering Environment	Cementitious waterproofing grout
PVC, CPVC, and FRP Coating Systems		
51.	PVC, CPVC, and FRP, Ultraviolet Exposure or Color Coding	Epoxy/aliphatic acrylic polyurethane
Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems		
61.	Aluminum Insulation from Concrete and Carbon Steel	Polyamide epoxy-coal-tar primer and finish
62.	Galvanized Steel, Stainless Steel, Aluminum, or Copper	Low-Stress Epoxy/ Aliphatic Polyurethane/ Aliphatic Polyurethane

A. These systems are specified in detail in the following paragraphs. For each system, the required surface preparation, coating materials, and thickness are described. If the specified surface preparation, coating materials, or thickness differs from the coating manufacturer's written instructions at the time of application, the manufacturer's instructions shall govern.

B. Only products of one manufacturer may be used throughout any particular coating system.

C. The following products are listed as a reference standard for this Section. All high-performance coatings shall be a product of Tnemec International or Induron. No other manufacturers will be permitted with prior approval of the Engineer.

D. To be considered for approval, potential alternate products must:

1. Be submitted by the manufacturer a minimum of 10 days before the project bid date to allow time for review.
2. Be the same generic type and have the same solids by volume (sbv).
3. Maintain the specified total dry film thickness.
4. Meet or exceed the performance criteria of the originally specified coatings in Article 2.02 of this Section.

5. Include a side-by-side comparison of equality including generic coating description, volume solids, ASTM performance test results, etc.
6. Be endorsed by the manufacturer for their intended use on the project.

E. All dry film thicknesses in the coating systems below are listed in mils.

F. Submerged Metal Coating Systems

1. System No. 2—Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments:

   a. Type: Tnemec Series 104 Cycloaliphatic Amine Epoxy (82% sbv) with a Series 1 Omnithane Zinc/Micaceous Iron Oxide Blend Modified Aromatic Polyurethane Primer (61% sbv) at a total film thickness of 14.5 to 19.5 mils.
   b. Service Conditions: For use with metal pipes or structures (such as scum troughs, sluice gates, clarifier mechanisms, or piping) continuously submerged in mild to moderate (aerobic) wastewater conditions, such as clarifiers, chlorine contact basins, aeration basins, settling basins, and other open-top structures.
   c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface; abrasive blast in accordance with SSPC SP-10/NACE No. 2.
   d. Prime Coat: Tnemec Series 1 Omnithane at 2.5 to 3.5 mils.
   e. Stripe Coat (Weld Seams and Edges): Tnemec Series 104 Hi-Build Epoxoline at 4.0 to 6.0 mils.
   f. Intermediate Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.
   g. Finish Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.
   h. UV-Resistant Topcoat (Areas above the Waterline, extending down 1’ below the waterline): Tnemec Series 1095 Endura-Shield at 2.5 – 5.0 mils.

2. System No. 5—Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage, or Grit Slurries:

   a. Type: Two-component epoxy resin/ceramic having 100% volume solids and having the following characteristics:

Tensile shear adhesion (ASTM D1002):	2,500 psi (min)
Shore D hardness (minimum):	85
Abrasion resistance (ASTM D4060):	0.8 mg (max) loss per 1,000 cycles

b. Service Conditions: For use as a lining for pump volutes, pump impellers, piping, valves, and heat exchanger tubes subject to severe abrasion service.

c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-10/NACE No. 2.

d. Coating System: Apply two coats (each a different color) to a minimum thickness of 10 mils per coat. Minimum total coating thickness shall be 20 mils. Product: THORTEX Cerami-Tech C.R. as applied by Western Industrial Technology, Inc., Fullerton, California, or Paragon Industries, Horsham, Pennsylvania; Belzona 1341; or equal.

G. Exterior/UV-Exposed Metal Coating Systems

1. System No. 12—Exposed Metal, Non-Immersion Environment:

a. Type: Tnemec Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane finish (66% sbv) with a Series 66 Hi-Build Epoxoline Polyamide Epoxy (56% sbv) primer and intermediate coat at a total film thickness of 8.5 to 17.0 mils.

b. Service Conditions: For use with metal structures or pipes subjected to non-immersion conditions, where high-performance corrosion resistance, high-performance color and gloss retention, or resistance to chemical vapors are desired. This system is not suitable for areas of high H_2S concentrations or other similar extremely corrosive atmospheres.

c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-6/NACE No. 3.

d. Prime Coat: Tnemec Series N140 Pota-Pox Plus or Series 66 Hi-Build Epoxoline at 3.0 to 6.0 mils.

e. Intermediate Coat: Tnemec Series 66 Hi-Build Epoxoline at 3.0 to 6.0 mils.

f. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.5 to 5.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

2. System No. 13—Exposed Metal, Mild Environment, Exposed to Atmospheric Weathering and Water Condensation:

    a. Type: Tnemec Series 1029 Enduratone HDP Acrylic Polymer (40% sbv, 100% acrylic resin) with a Series 1 Omnithane Zinc/Micaceous Iron Oxide Blend Modified Aromatic Polyurethane Primer (61% sbv) at a total film thickness of 6.5 to 9.5 mils.
    b. Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.
    c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast to a minimum cleaning in accordance with SSPC SP-6/NACE No. 3. SSPC SP-10/NACE No. 2 is preferred.
    d. Prime Coat: Tnemec Series 1 Omnithane at 2.5 to 3.5 mils.
    e. Intermediate Coat: Tnemec Series 1029 Enduratone at 2.0 to 3.0 mils. Series 1029 is low semi-gloss. For a different finish, apply Series 1026 (matte) or Series 1028 (gloss) at the same thickness.
    f. Finish Coat: Tnemec Series 1029 Enduratone at 2.0 to 3.0 mils. Series 1029 is low semi-gloss. For a different sheen, apply Series 1026 (matte) or Series 1028 (gloss) at the same thickness.

3. System No. 14—Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up:

    a. Type: Tnemec Series 90-97 Tneme-Zinc aromatic zinc-rich urethane (63% sbv, 83% zinc) primer at a dry film thickness of 2.5 to 3.5 mils.
    b. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
    c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-10/NACE No. 2.
    d. Coating: Tnemec Series 90-97 at 2.0 to 3.5 mils. For single-component application, apply Series 90G-1K97 at the same thickness instead.

H. Buried Metal Coating Systems

1. System No. 21—Buried Metal:

a. Type: Tnemec Series N140 Pota-Pox Plus Polyamidoamine Epoxy (67% sbv) primer, Series 66 intermediate and finish coat with a UV-stable fourth coat for exposed non-immersion areas. Total film thickness without fourth coat is 9.0 to 18.0 mils.
b. Service Conditions: Buried metal, such as pipe exteriors, valves, flanges, bolts, nuts, structural steel, and fittings.
c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-10/NACE No. 2.
d. Prime Coat: Tnemec Series N140 Pota-Pox Plus or Series 66 Hi-Build Epoxoline at 3.0 to 6.0 mils.
e. Intermediate Coat: Tnemec Series 66 Epoxoline at 3.0 to 6.0 mils.
f. Finish Coat: Tnemec Series 66 Epoxoline at 3.0 to 6.0 mils.
g. UV-Stable Fourth Coat (UV-exposed, non-immersion areas): Tnemec Series 1095 Endura-Shield at 2.5 to 5.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

2. System No. 24—Buried Metal Piping and Tubing:

a. Type: Cold-applied coal-tar tape or hot-applied coal-tar tape.

b. Service Conditions: Buried ferrous and nonferrous piping and tubing.

c. Coat with one of the following systems:

(1) Wrap with cold-applied coal-tar tape conforming to AWWA C209. Minimum thickness of tape shall be 35 mils. Apply tape with manufacturer's prime coat. Tape shall be Tapecoat CT, Protecto-Wrap 200, or equal.
(2) Wrap with hot-applied coal-tar tape conforming to AWWA C203, Section 4.6. Minimum thickness of tape shall be 50 mils. Apply tape with manufacturer's recommended prime coat. Tape shall be Tapecoat 20, Protecto-Wrap 110, or equal.

d. Use chloride-free primers with the above coatings when applying to stainless steel piping or tubing.

e. Coat field joints of buried piping that has a shop-applied coating with primer and tape conforming to AWWA C209. Use Type 1 tape of 35-mil thickness. Products: Protection Engineering Co. Protecto Wrap 200 GT, Tapecoat CT10/40W, Polyken 930-35, or equal.

f. Perform electrical inspection of shop- and field-coating in accordance with Section 5 of AWWA C209.

g. Install buried pipes with wrapped coatings by extending the wrapping to the first joint after entering a building, penetrating a slab, or 6 inches above finished grade. Wrap joints spirally with a minimum overlap of 50% of the tape width.

I. Submerged Concrete and Masonry Coating Systems

1. System No. 31—Anaerobic Severe Wastewater Environments with Elevated H_2S Levels, Raw Water (Nonpotable), Raw Sewage, or Chemical Waste Immersion:

a. Type: Tnemec Series 435 Perma-Glaze Modified Polyamine Epoxy (100% sbv) finish coat with a Series 434 Perma-Shield H_2S Modified Aliphatic Amine Epoxy Mortar (100% sbv) base coat at a total film thickness of 143.0 mils.

b. Service Conditions: Concrete and masonry exposed to raw sewage or raw water (nonpotable) in anaerobic environments and exposed to a moist saturated hydrogen sulfide (H_2S) atmosphere, as in raw sewage wet wells, lift stations, headworks, and all other closed-top (anaerobic) wastewater structures, including those with odor control systems.

c. Surface Preparation: In accordance with Article 3.04. Clean to an ICRI CSP 5 standard.

d. Resurfacing: Apply Tnemec Series 218 to all surfaces at a nominal 1/16 inch and as needed to bring surfaces to level and create a smooth paintable surface. For localized repairs of large bugholes, honeycombs, and other cavities deeper than the recommended maximum thickness, clean sand or pea gravel may be post-added to Series 218. If more than 1/4-inch of repairs is needed, Series 217 may be used.

e. Coating System: Tnemec Series 435 Perma-Glaze at 50.0 to 60.0 mils.

2. System No. 32—Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment:

    a. Type: Tnemec Series 104 HS Epoxy Cycloaliphatic Amine Epoxy (82% sbv) primer, intermediate and finish coat at a total dry film thickness of 18.0 to 24.0 mils.
    b. Service Conditions: Concrete and masonry exposed to mild to moderate corrosive atmospheres and immersion service, such as chlorine contact basins, chlorine storage areas, or open-top (aerobic) clarifiers, aeration basins, settling basins, etc.
    c. Surface Preparation: In accordance with Article 3.04. Clean to an ICRI CSP 5 standard.
    d. Resurfacing: Apply Tnemec Series 218 to all surfaces at a nominal 1/16 inch and as needed to bring surfaces to level and create a smooth paintable surface. For localized repairs of large bugholes, honeycombs, and other cavities deeper than the recommended maximum thickness, clean sand or pea gravel may be post-added to Series 218. If more than 1/4-inch of repairs is needed, Series 217 may be used.
    e. Prime Coat: Tnemec Series 104 at 6.0 to 8.0 mils.
    f. Intermediate Coat: Tnemec Series 104 at 6.0 to 8.0 mils.
    g. Finish Coat: Tnemec Series 104 at 6.0 to 8.0 mils.
    h. UV-Resistant Topcoat (Areas above the Waterline, extending down 1 foot below the waterline): Tnemec Series 1095 Endura-Shield at 2.5 to 5.0 mils.

J. Exterior/UV-Exposed Concrete and Masonry Coating Systems

1. System No. 41—New or Bare Concrete and Masonry, Atmospheric Weathering Environment:

    a. Type: Tnemec Series 156 Enviro-Crete Modified Waterborne Acrylate (50.9% sbv) primer and finish coat with a Series 1254 EpoxoBlock WB inorganic hybrid water-based epoxy (100% sbv) block filler at a total dry film thickness of 8.0 to 16.0 mils.
    b. Service Conditions: Exterior concrete or masonry, exposed to ultraviolet light and weathering, which requires protection from hairline cracking, driving rain, or mold and mildew.
    c. Surface Preparation: Prepare in accordance with Article 3.04. Concrete surfaces shall have a Thoroseal or stucco finish, or similar. If surfaces do not have a bughole-free finish already then they will require additional sandblasting and application of Series 218.

d. Masonry Block Filler (CMU Only): Tnemec Series 1254 EpoxoBlock WB at a rate of 100 to 150 square feet for dense substrates or 75 to 100 square feet for porous substrates.
e. Prime Coat: Tnemec Series 156 Enviro-Crete at 4.0 to 8.0 mils.
f. Finish Coat: Tnemec Series 156 Enviro-Crete at 4.0 to 8.0 mils.

2. System No. 45—Exposed Masonry or Concrete, Atmospheric Weathering Environment:

a. Type: Cement-base waterproofing grouting for concrete and masonry.
b. Service Conditions: For use in waterproofing concrete, block, brick, stone, and other masonry.
c. Surface Preparation: In accordance with Article 3.04. Dampen surface immediately ahead of application with clean water. Follow manufacturer's instructions on mixing and application.
d. Coatings: Apply two or more coats of Bonsal Sure-Coat to minimum total thickness of 1/16 inch or evenly distribute a base coat of Thoro Systems Products "Thoroseal" or equal, minimum 2 pounds per square yard. Then apply another coat at 2 pounds per square yard for a total of 4 pounds per square yard.

K. PVC, CPVC, and FRP Coating Systems

1. System No. 51—PVC, CPVC, and FRP, Ultraviolet Exposure or Color Coding:

a. Type: Tnemec Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane (66% sbv) finish with a Series 66 Hi-Build Epoxoline Polyamide Epoxy (56% sbv) prime coat at a total dry film thickness of 4.5 to 10.0 mils.
b. Service Conditions: Color coding of PVC, CPVC, or FRP exposed to sunlight.
c. Surface Preparation: Clean the surface in accordance with SSPC SP-1. Then, thoroughly and uniformly scarify and de-gloss the surface.
d. Prime Coat: Tnemec Series 66 at 2.0 to 3.0 mils.
e. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.5 to 5.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

L. Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems

1. System No. 61—Aluminum Insulation from Concrete and Carbon Steel:

   a. Type: Tnemec Series 46H-413 Hi-Build Tneme-Tar (75% sbv) prime and finish coats at a total dry film thickness of 16.0 to 20.0 mils.
   b. Service Conditions: Coat areas of aluminum grating, stairs, structural members or aluminum fabrications, in contact with concrete or carbon steel with this system.
   c. Surface Preparation: Clean the surface in accordance with SSPC SP-1. Then, thoroughly and uniformly scarify and de-gloss the surface. Primer must be applied as soon as possible on the same day as surface preparation.
   d. Prime Coat: Tnemec Series 46H-413 at 8.0 to 10.0 mils.
   e. Finish Coat: Tnemec Series 46H-413 at 8.0 to 10.0 mils.

2. System No. 62—Galvanized Steel, Stainless Steel, Aluminum, or Copper:

   a. Type: Tnemec Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane (66% sbv) finish with a Series 3600 Probond (100% sbv) prime coat at a total dry film thickness of 5.0 to 10.0 mils.
   b. Service Conditions: Coat area of material using this system. Consult with coating manufacturer for immersion service requirements.
   c. Surface Preparation: Clean the surface in accordance with SSPC SP-1. Primer must be applied as soon as possible on the same day as surface preparation.
   d. Prime Coat: Tnemec Series 3600 at 1.0 to 2.0 mils.
   e. Intermediate Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 44.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.
   f. Finish Coat: Tnemec Series 66 at 2.0 to 4.0 mils.
   g. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 4.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

M. Organic Zinc Primer for Field Touch-Up and Shop Coating

1. Where shop-applied inorganic zinc primers cannot be used because of VOC regulations, the organic zinc primer described in System No. 14 may be substituted for the specified inorganic zinc primers.

2.02 PERFORMANCE CRITERIA

The following shall serve as a basis of comparison for material substitution requests. Any substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved.

A. Series 1 Omnithane – Zinc/Micaceous Iron Oxide Urethane

1. Adhesion: ASTM D4541 (Method B, Type II) – No less than 1,433 psi (9.88 MPa) adhesion, average of three tests.
2. Salt Spray (Fog): ASTM B117 – No blistering, cracking, or delamination of film. No more than .03% rusting on plane and no more than 3/16-inch rust creepage at scribe after 10,000 hours exposure.

B. Series 22 Epoxoline – Modified Polyamine Epoxy

1. Special Qualification: Certified by NSF International in accordance with NSF 61.
2. Product must be able to be applied in one single-coat application from 16.0 to 40.0 mils dry film thickness.
3. VOC Content: 0.10 pound/gallon (12 grams/liter).
4. Immersion: ASTM 870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.

C. Series 46H-413 Hi-Build Tneme-Tar – Polyamide Epoxy-Coal Tar

1. Adhesion: ASTM D4541 – Exceeds the cohesive strength of the concrete substrate (400 psi), average of three tests.
2. Abrasion: ASTM D4060 (CS-17 wheel, 1,000 gram load) – No more than 142 mg loss after 1,000 cycles.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 9,000 hours continuous exposure.

D. Series 66 Hi-Build Epoxoline – Polyamide Epoxy

1. Adhesion: ASTM D4541 – No less than 1,930 psi (13.31 MPa) pull, average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, checking, or delamination of film. No more than 1/8-inch rust creepage at scribe after 8,000 hours exposure.

E. Series 90-07 Tneme-Zinc – Aromatic Zinc-Rich Urethane

1. Zinc Pigment: 83% by weight in dried film.
2. Adhesion: ASTM D4541 (Type II) – No less than 1,442 psi (9.94 MPa) adhesion, average of three tests.
3. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No more than 1/8-inch creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

F. Series 94H_2O Hydro-Zinc – Zinc-Rich Aromatic Urethane

1. Special Qualification: Certified in accordance with NSF 61 for use on interior potable water tanks of 500 gallons or greater.
2. Zinc Pigment: 83% by weight in dried film.
3. Adhesion: ASTM D4541 (Type V Self-Aligning Adhesion Tester) – No less than 1,713 psi adhesion, average of three tests.
4. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No rusting on plane and no more than 1/16-inch rust creepage at scribe after 10,000 hours.

G. Series 104 HS Epoxy – Cycloaliphatic Amine Epoxy

1. Adhesion: ASTM D4541 – No less than 900 psi (6.21 MPa) pull, average of three tests.
2. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, or delamination of film after 7 days.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/32-inch (0.8 mm) rust creepage at scribe after 1,500 hours exposure.

H. Series 115 Uni-Bond DF – Self-Crosslinking Hydrophobic Acrylic

1. Adhesion: ASTM D4541 (Method C – Type V Tester) – No less than 1,472 psi pull (10.15 MPa), average of three tests.
2. Salt Spray: ASTM B117 – No more than 1/64-inch rust creepage at scribe, no more than 3% rusting on plane, and no less than a blister rating of 8 after 500 hours exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, rusting, or delamination of film after 2,000 hours exposure.

I. Series N140 Pota-Pox Plus – Polyamidoamine Epoxy

1. Adhesion: ASTM D4541 – No less than 1,943 psi (13.40 MPa) pull, average of three tests.

2. Exterior Exposure: ASTM D1014 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 5 years exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, or delamination of film after 10,000 hours exposure.
4. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F, average of three tests.
5. Salt Spray (Fog): ASTM B117 (Two Coats Series N140) – No blistering, cracking, or delamination of film. No more than 1% rusting on plane. No more than 1/16-inch rust creepage at scribe after 6,700 hours exposure.
6. Salt Spray (Fog): ASTM B117 (Series 91H_2O and Two Coats Series N140) – No blistering, cracking, checking, or delamination of film. No more than 1% rusting on plane and no more than 3/16-inch rust creepage at scribe after 20,000 hours exposure.

J. Series 142 Epoxoline – Modified Polyamine Epoxy

1. Suitable for methanol immersion service.
2. Adhesion: ASTM D4541 – No less than 2,042 psi (14.08 MPa) pull, average of three tests.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film and less than 1/32-inch creepage at the scribe after 5,000 hours exposure.
4. Abrasion: ASTM D4060 – No more than 59.3 mg loss after 1,000 cycles, average of two tests.

K. Series 156 Enviro-Crete – Modified Waterborne Acrylate

1. Adhesion: ASTM D7234 – Exceeds the cohesive strength of concrete substrate (400 psi), average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No visible damage to coating or substrate after 5,000 hours.
3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of the film. No less than 69% gloss retention, no more than 1.1 units gloss loss, and no more than 3.59 DE (FMC-2) color change (white) after 5,000 hours QUV exposure.
4. Fungal/Mold/Mildew Resistance: ASTM D3273 – No More than slight mold growth after 5 weeks exposure.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 – Elongation no less than 200%, average of five tests. Tensile strength no less than 250 psi (1.7 MPa), average of three tests.

6. Wind Driven Rain Resistance: ASTM D6904 – No damage to coating or substrate. No visible moisture on the back of lightweight block after 48 hours exposure.

L. Series 239SC Chemblock – Modified Novolac Polyamine Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Flexural Strength and Modulus of Elasticity: ASTM D790 – Not less than 6,270 psi (43.23 MPa) flexural strength and 323,900 psi (2,233 MPa) flexural modulus of elasticity, average of five tests.
4. Impact: MIL D3134 (modified using 2.5 pound steel ball) – No more than 1/16-inch permanent indention. No cracking, checking, or delamination of film after 240 in-lb (27 J) direct impact, average of three tests.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D638 – No less than 7,913 psi (54.56 MPa) tensile strength, 222,975 psi (1,537 MPa) tensile modulus of elasticity and 6.14% elongation at break.

M. Series 241 Ultra-Tread MVT – Polyurethane Modified Concrete

1. Can be applied to 10-day old concrete.
2. Withstands moisture vapor transmission up to 20 pounds in accordance with ASTM F1869.
3. Withstands relative humidity up to 99% in accordance with ASTM F2170.
4. Adhesion: ASTM D7234 – Exceeds the cohesive strength of the concrete substrate (approximately 400 psi), average of three tests.
5. Compressive Strength: ASTM C579 – No less than 4,922 psi (33.94 MPa) compressive strength, average of six tests.
6. Flexural Strength and Modulus of Elasticity: ASTM C580 – No less than 2,438 psi (16.81 MPa) flexural strength and 313,614 psi (2,162 MPa) modulus of elasticity (tangent), average of five tests.
7. Tensile Strength: ASTM C307 – No less than 1,015 psi (7.00 MPa) tensile strength, average of six tests.

N. Series 248 Everthane – Aliphatic Moisture Cured Urethane

1. Chemical Resistance: Tnemec Test Method-59 (TTM-59) (ASTM D1308) (Covered Spot Test) – No blistering, cracking, checking, or delamination of film. No more than slight softening or very slight swelling and loss of gloss after 24 hours exposure to the following reagents: 30% Sulfuric Acid, 10% Hydrochloric Acid, 50% Phosphoric Acid, 10% Acetic Acid,

50% Sodium Hydroxide, 10% Ammonium Hydroxide, Methyl Ethyl Ketone, Ethyl Alcohol, Hexane, Xylene, Gasoline, Ethylene Glycol, Skydrol, Brake Fluid, Transmission Fluid, Aviation Gas, Jet Fuel (JP4).

2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 18 mg loss after 1,000 cycles, average of three tests.

O. Series 282 Tneme-Glaze – Polyamine Novolac Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Immersion: 140°F Deionized Water Immersion – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion.
4. Impact: ASTM D2794 – No visible cracking or delamination of film after 59 in/lbs direct impact, average of three tests.
5. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/16-inch rust creepage at scribe after 3,500 hours exposure.

P. Series 365 Tank Armor – Novolac Epoxy

1. Suitable for immersion service in 98% sulfuric acid.
2. Adhesion: ASTM D4541, Type II – No less than 1,650 psi (11.38 MPa) adhesion, average of three tests.
3. Hardness: ASTM D2240 (Shore D Durometer) – Not less than 90 Shore Type D hardness, average of five tests.

Q. Series 431 Perma-Shield PL – Modified Polyamine Ceramic Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 11.18 log-Z at 0.001 Hz (ohms cm^2). No blistering, cracking, checking, or delamination. No less than 88.7% EIS retention or not more than 1.26 ohms cm^2 reduction in log-Z electrochemical impedance at 0.001 Hz after 28 days exposure. No less than 2,363 psi (16.30 MPa) adhesion or no loss of adhesion after 28 days in S.W.A.T., average of three tests.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 cycles, 1,000 gram load) – No more than 41 mg loss, average of three tests.
3. Abrasion Resistance: BS EN 598: 2007+A1: 2009 (Rocking Abrasion) – No more than 0.14 mm (5.5 mils) thickness of coating loss after 1,000,000 cycles.

R. Series 434 Perma-Shield H_2S – Modified Aliphatic Amine Epoxy Mortar

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.6 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 86.7% retention or not more than 1.4 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 88 mg loss after 1,000 cycles, average of three tests.
3. Impact: ASTM D2794 – No visible cracking or delamination after 160 inch-pounds (18.1 J) direct impact.
4. Compressive Strength: ASTM D695 – Not less than 12,331 psi (85.0 MPa) compressive strength, average of five tests.

S. Series 435 Perma-Glaze – Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 12.46 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, checking, or delamination. No less than 84.3% retention and no more than 1.95 ohms cm² reduction in electrochemical impedance after 28 days exposure. No less than 93% loss of tensile adhesion after 28 days in S.W.A.T. average of three tests.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 72 mg loss after 1,000 cycles, average of three tests.

T. Series 436 Perma-Shield FR – Fiber-Reinforced Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.2 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 83.7% retention or not more than 1.6 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 74.6 mg loss after 1,000 cycles, average of three tests.
3. Impact: ASTM D2794 – No visible cracking or delamination of film after 88 inch-pounds direct impact.
4. Compressive Strength: ASTM D695 – No less than 8,866 psi (6.13 MPa) compressive strength, average of five tests.

U. Series 626 Dur A Pell GS – RTV Silicone Rubber Water and Graffiti Protectant

1. Accelerated Weathering: ASTM C793 – No signs of deterioration except for dirt accumulation after 4,000 hours exposure.
2. Chloride Ion Penetration: AASHTO T-259 – No less than a 1500% reduction in the chloride ion content when compared to untreated concrete, average of two tests.

V. Series 662 Prime-A-Pell Plus – Modified Siloxane/Silane with Diffused Quartz Carbide

1. QUV Exposure: ASTM D4587 (UVA-340 bulbs, Cycle 4: 8 hours UV/4 hours condensation) – No reduction in water repellent performance after 5,000 hours exposure.
2. Water Absorption: ASTM C67/C67M (Applied to Ohio Sandstone) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
3. Water Absorption: ASTM C97/C97M (Applied to Fire Clay Brick) – No less than a 93% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
4. Water Absorption: ASTM C140/C140M (Applied to Cast Mortar Cubes) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.

W. Series 700 Hydroflon – Advanced Thermoset Solution Fluoropolymer

1. Exterior Exposure: ASTM D1014 (AAMA 2604) (South Florida Marine Exposure) – Exceeds the exterior weathering requirements of AAMA 2604 standard.
2. Exterior Exposure: ASTM D4141/D4141M, Method C (EMMAQUA) – No blistering, cracking, or chalking. No less than 100% gloss retention, no more than 1 unit gloss loss and no more than 0.23 DEHunter color change (white) after 1,500 MJ/m² (69,109MJ/m² total) EMMAQUA exposure.
3. QUV Exposure: ASTM D4587 – No blistering, cracking, or chalking. No less than 61% gloss retention (31.4 units gloss change) and 1.89 DEFMC2 (MacAdam units) color change (white) after 25,000 hours exposure.
4. Xenon Arc Weathering: ASTM D6695 – No blistering, cracking, or chalking. No less than 87% gloss retention (11.9 units gloss change) and no greater than 0.37 DE00 color change (white) after 8,000 hours Xenon Arc exposure.

X. Series 971 Aerolon – Fluid-Applied Acrylic Insulation Coating

1. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.
2. Thermal Conductivity: ASTM C518 – Thermal conductivity shall not be greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft²-hr-°F (R-value at 1 inch equals 4.1).

Y. Series 1026 Enduratone – Acrylic Emulsion

1. VOC Content: 0.38 pounds/gallon (1.4 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of film. No less than 49% gloss retention (2.3 units gloss change) and 0.39 DE00 color change after 10,000 hours exposure.

Z. Series 1029 Enduratone – HDP Acrylic Polymer

1. Algal Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 3 weeks continuous exposure.
2. Fungal/Mold/Mildew Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 4 weeks continuous exposure.
3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination of film. No less than 100% gloss retention, no more than 0.45 DE00 color change and no unit gloss loss after 3,000 hours.

AA. Series 1095 Endura-Shield – Aliphatic Acrylic Polyurethane

1. Volatile Organic Compounds (Thinned 5%): 0.77 pounds/gallon (92 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination. No less than 52% gloss retention or 23 units gloss change and 0.59 DECIE2000 color change (white) after 2,000 hours exposure.

PART 3 EXECUTION

3.01 WEATHER CONDITIONS

A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.

B. Do not apply paint when the relative humidity is above 85% or otherwise outside the manufacturer's recommended level.

C. Do not paint when temperature of the substrate is outside of the manufacturers listed surface temperature requirement.

3.02 SURFACE PREPARATION PROCEDURES

A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Remove sharp edges, burrs, and weld spatter.

D. Do not abrasive blast or prepare more surface area in 1 day than can be coated in 1 day; prepare surfaces and apply coatings the same day. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Prime all areas before rust bloom forms and within the same day.

E. Surface preparation shall conform to the SSPC and NACE Standards as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5/NACE No. 1
Commercial Blast Cleaning	SP-6/NACE No. 3
Brush-Off Blast Cleaning	SP-7/NACE No. 3
Pickling	SP-8
Near-White Blast Cleaning	SP-10/NACE No. 2
Power Tool Cleaning to Bare Metal	SP-11
High- and Ultra-High-Pressure Water Jetting	SP-12/NACE No. 5
Surface Preparation of Concrete	SP-13/NACE No. 6
Industrial Blast Cleaning	SP-14/NACE No. 8
Waterjet Cleaning of Metals – Clean to Bare Substrate	SP WJ-1
Waterjet Cleaning of Metals – Very Thorough Cleaning	SP WJ-2
Waterjet Cleaning of Metals – Thorough Cleaning	SP WJ-3
Waterjet Cleaning of Metals – Light Cleaning	SP WJ-4

F. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these Specifications or in the paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC, surface preparation specifications listed above.

G. *Brush-off blasting* of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

H. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be angular and from 2.0 to 3.0 mils unless specified otherwise. Verify the surface profile by measuring with an impresser tape acceptable to the Owner’s Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner’s Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner’s Representative.

I. Do not apply any part of a coating system before the Owner’s Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner’s Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting.

C. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating. If enough time has elapsed that a bare surface no longer meets the surface cleanliness requirement, that surface must be re-blasted until the surface cleanliness requirement is met.

D. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

E. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE No. 6 and the following.

B. Do not apply coating until concrete has cured at least 28 days at 75^0F. Finish concrete surfaces in accordance with Division 3, Concrete. Do not use curing compound on surfaces that are to be coated.

C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.

D. Detergent clean the concrete or masonry surface with Trisodium Phosphate in accordance with ASTM D4258. Then abrade or blast surfaces to the required surface profile. Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or ASTM D4261. Use ICRI standards for concrete and masonry surface preparation.

E. All concrete which has been subjected to low-pH or acidic conditions must be confirmed to have a pH of 9 or greater prior to application of coatings. If the desired surface profile has been achieved without a minimum pH of 9, that surface shall be considered contaminated and in need of further abrasion or blasting.

F. Before coating concrete, plaster, and masonry that is below-grade, on-grade, or new, determine the presence of capillary moisture in accordance with ASTM D4263, except as modified below. Tape a 4-foot-by-4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 500 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.

G. Acceptance criteria for concrete surfaces shall be in accordance with SSPC SP-13, Table 1, “Severe Service” or this Section, whichever is more stringent.

H. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable or declining, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

3.05 COATING STAINLESS STEEL, NONFERROUS, AND COPPER

A. Solvent clean in accordance with SSPC SP-1. Solvents and cleaning solutions shall contain less than 200 mg/l of halogens. Then prepare in accordance with the specified coating system.

B. All surfaces must be primed as soon as possible on the same day following surface preparation.

3.06 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.

B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.07 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use

a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of Trisodium Phosphate, detergent, and water. Rinse scrubbed surfaces with clean water.

C. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by scrubbing with a stiff bristle brush.

D. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7/ NACE No. 4. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.

E. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10/NACE No. 2. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

F. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

G. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.08 PAINTING SYSTEMS

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.09 PAINT STORAGE AND MIXING

A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures

taken to prevent fire hazards. Post “No Smoking” signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use.

B. Store paint in accordance with the manufacturer’s latest written recommendations, or at an ambient temperature from 50°F to 100°F, whichever is more stringent.

C. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.10 PROCEDURES FOR THE APPLICATION OF COATINGS

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as determined in accordance with SSPC PA-2.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.

G. Apply a brush coat of the specified primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the prime coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

I. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.

J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.

K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.11 SURFACES NOT TO BE COATED

A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other Specification sections. Protect the following surfaces during the painting of adjacent areas:

1. Concrete walkways.
2. Mortar-coated pipe and fittings.
3. Stainless steel.
4. Metal letters.
5. Glass.
6. Roofing.
7. Fencing.
8. Copper tubing, red brass piping, and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.
9. Electrical fixtures except for factory coatings.
10. Nameplates.

11. Grease fittings.
12. Brass and copper.
13. Buried pipe, unless specifically required in the piping specifications.
14. Fiberglass items, unless specifically required in the FRP specifications.
15. Aluminum handrail, stairs, and grating.
16. Insulated pipe.

3.12 PROTECTION OF SURFACES NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.13 SURFACES TO BE COATED

A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

1. Coat mechanical equipment, such as pumps, blowers, and clarifier mechanisms, as described below. The color of the finish coat shall be as shown below.

2. Coat aboveground and exposed steel piping or piping in vaults and structures as described below and as shown in the Piping Schedule in the drawings**.** Coat exposed PVC, CPVC, and FRP piping as specified in System No. 51. The color of the finish coat shall be as shown in the Piping Schedule in the drawings.

3. Coat submerged steel and ductile iron piping, including pipe hangers and supports, metal valves, stem guides, extension stems, and bonnets as specified in System No. 2 or 21.

4. Coat valves the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping. If the adjacent piping is not coated, coat valves as specified in System No. 12. Coat buried metal valves at the place of manufacture as specified in System No. 21. Apply the specified prime and finish coat at

the place of manufacture. The finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

5. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze stainless-steel pieces, as specified in System No. 5. Apply lining at the place of manufacture.

6. Coat floor stands as specified in System No. 12.

7. Coat concrete and masonry surfaces where shown in the structural drawings and Division 3, Concrete.

8. Coat aluminum surfaces in contact with concrete as specified in System No. 61.

9. Coat buried flanges, nuts and bolts, washers, rods, harnesses, clamps, sleeves, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in System No. 24. Coat buried cast iron pieces as specified in System No. 21.

10. Coat aboveground structural steel or structural steel located in vaults and structures as described below.

11. Coat exposed indoor galvanized electrical conduit or exposed metallic pipe hangers and supports as specified in System No. 62. Color of finish coat shall be OSHA Safety Orange.

12. Coating Schedule:

Surface or Item	Coating System No.
Pumps (exposed components)	12
Pumps (submerged components)	2
Clarifier mechanisms	2
Exposed ferrous piping	12
Submerged ferrous piping	2
Exposed ferrous valves	12
Buried valves	21
Submerged valves	2
Exposed plastic piping	51

Surface or Item	Coating System No.
Concrete Floor, Pads, Walls, Top of Walls – Chlorine Tank Containment Area	32 (*)
Concrete – Floor, Walls, Top of Walls – Chlorine Contact Basins	32 (*)

Notes: (*) Color shall be TNEMEC 29BL SPRINGWATER or equal. Submit color for Owner and Engineer approval.

3.14 DRY-FILM THICKNESS TESTING

A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge in accordance with ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Rasor, K-D Bird Dog, or similar. Test using voltages recommended by the coating manufacturer.

C. If the Owner's representative suspects low film thickness, the coating thickness for concrete or masonry surfaces may be measured in accordance with ASTM D4138 (tooke gauge). Use of a "tooke" gauge is classified as a destructive test. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.

D. For severe environments, test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.

E. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.

F. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for

each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

G. Perform tests in the presence of the Owner's Representative.

3.15 REPAIR OF IMPROPERLY COATED SURFACES

A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.16 CLEANING

A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.

B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11000
GENERAL EQUIPMENT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general work requirements regarding the products and execution services that are specified in the Division 11 Sections incorporated in the Contract Documents. The requirements specified shall apply to all of the Division 11 Sections, unless noted otherwise.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The submittal contents for equipment, instrumentation, controls, and appurtenances specified in the Division 11 Sections shall contain the general information listed below. Additional submittal requirements are contained in the Division 11 Sections.

1. A list and description of all deviations from the Contract Documents.
2. A list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
3. Completely dimensioned plans, elevations, and cross-sections of system equipment and sub-assemblies.
4. Shop and erection drawings showing details, anchor bolt locations, and field connections.
5. Manufacturers' equipment installation instructions.
6. Descriptive literature, technical bulletins, and catalog data sheets for all equipment and purchased sub-components.
7. Installation, operation, maintenance and start-up procedures.
8. Total equipment weight (while operating).
9. Drive mechanism torque rating and bearing life rating.
10. Motor data and catalog information.
11. Submit complete electrical drawings, schematics, and interconnecting wiring diagrams and schedules for the equipment control system, instrumentation, and control panel(s) showing numbered wiring terminals in the control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.

12. Control panel construction and panel layout drawings.
13. Complete technical literature for all factory-applied paint systems. Clearly indicate the components to be coated and the corresponding paint system.
14. Manufacturers' descriptive literature, product specifications, and published details.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. National Electrical Manufacturers Association (NEMA)

1. NEMA ICS-1—Industrial Control and Systems: General Requirements.

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: The Contractor shall comply with construction requirements of State, County, and other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced in this Section.

1. NFPA Standards: The Contractor shall comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections and as directly appropriate to the work and workmanship.
2. Electrical Requirements: The Contractor shall comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the NEMA Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

B. Certificates and Permits: Upon completion of work and before final payment, the Contractor shall furnish to the Engineer formal certification of final inspections from authorities having jurisdiction over the work in this project and secure required permits, if any, from such authorities. Additionally, the Contractor shall prepare any detailed diagrams and drawings that are required by those authorities having jurisdiction over the work of this project at no additional cost to the Owner.

C. Source Quality Control: Products used throughout these Specifications and as indicated on the Drawings shall be from companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified.

Such products may be of their own make or products of others for which they assume full responsibility when used in finished products which are not manufactured completely by them and with replacement parts available.

D. Products: The equipment specified in the Division 11 Sections was based on the latest models that were available from the specified equipment manufacturers at the time the Contract Documents were developed. If any equipment models specified in the Division 11 Sections have been discontinued or will be discontinued within 1 year after the bid date, the Contractor shall furnish and install the latest and most recent equipment model at no additional cost to the Owner.

E. For each category of materials and equipment (Products) specified in the Division 11 Sections, the Contractor shall provide Products of the same manufacturer and type.

F. Equipment Selection: The Contractor may furnish equipment of higher electrical characteristics, physical dimensions, capacities, and ratings provided such proposed equipment is approved by the Engineer in writing. Upon receiving the Engineer's approval to provide such equipment, the Contractor shall furnish the connecting mechanical and electrical services including but not limited to circuit breakers, conduit, increased control panel enclosure size, motors, bases, and any other electrical equipment needed to accommodate the higher electrical characteristics at no additional cost to the Owner.

G. If minimum energy ratings or efficiencies of equipment are specified in Division 11, Equipment, the Contractor shall furnish and install equipment that meets or exceeds the specified design and commissioning requirements (no exceptions) as determined by the Engineer.

H. All the equipment specified in the Contract Documents shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

1.05 QUALIFICATIONS

A. The manufacturer of each piece of equipment described in the Division 11 Sections shall meet the following requirements, unless noted otherwise:

1. Have a record of operation, manufacturing and servicing the items specified in the Division 11 Sections for a minimum of 10 years before the Bid Date.
2. Have a minimum of five installations of equipment similar to that specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.
3. Have been in business for at least the 10 consecutive years before the Bid Date.

B. If the equipment manufacturer that the Contractor proposes to furnish and install the equipment described in the Division 11 Sections does not meet these qualifications and is not specified in the Contract Documents, the Engineer reserves the right to reject the equipment from this manufacturer for use on this project. Any costs incurred by the Contractor as a result of providing equipment from a manufacturer that does not meet the qualifications described in this Section shall not be incurred by the Owner.

C. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

1.06 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the spare parts specified in the Division 11 Sections. The Contractor shall also submit a list of recommended spare parts, special tools, and lubricants for each equipment item. The list shall include contact information for local sources for supply of all parts and professional service.

PART 2 PRODUCTS

2.01 MOTORS

A. All motors identified in Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

2.02 CONTROLS

A. General

1. All control panels specified in the Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 13, Special Construction, and Division 16, Electrical.
2. The Contractor shall furnish and install controls designed to operate on 120-volt, single-phase, 60 Hertz electric service unless otherwise specified. The Contractor shall furnish and install 120-volt step-down voltage transformers as specified in Division 16, Electrical, in each control panel as required.
3. The Contractor shall furnish and install elapsed time meters in each control panel for each piece of motor-driven equipment being controlled by that control panel. All elapsed-time meters shall be furnished and installed in accordance with Division 16, Electrical.
4. All control panels shall be furnished with a main circuit breaker to enable/disable electric service to the panelboard.
5. All control panels that will annunciate a local and/or remote alarm shall be furnished with an ALARM ACKNOWLEDGE reset pushbutton switch (momentary contact) wired to each alarm contact.
6. Provide a heater inside of each control panel enclosure to prevent condensation. Heater size shall be in accordance with the equipment manufacturer's recommendations.
7. The face of each control panel shall be installed so it is facing north whenever possible or provided with a sunshield when not possible.

2.03 EQUIPMENT ANCHORING SYSTEMS

A. All anchoring systems including, but not limited to, expansion anchors, adhesive anchors, anchor bolts, cinch anchors, and screws that are required to install the equipment and appurtenances specified in the Division 11 Sections shall be AISI Type 316 stainless steel unless noted otherwise. The Contractor shall furnish and install all equipment anchoring systems in accordance with Section 03930, Modifications and Repair to Concrete, and Section 05500, Metal Fabrications.

2.04 EQUIPMENT NAMEPLATES

A. The Contractor shall provide engraved laminated phenolic nameplates with white legend and black field that provides the following information for each piece of equipment described in the Division 11 Sections.

1. Equipment Description (i.e., Influent Pumps, Rotary Drum Screen, Screenings conveyor, Package Plants, sludge pumps, Equalization basin

blower, Aeration/digester blower, Micro-C nutrient feed pump, Effluent Transfer Pumps, Plant Drain Pumps, hypochlorite pumps, No. #, etc.).

2. Equipment Identification Label No.

B. Letter height on each nameplate shall not be less than 3/4-inch. Nameplates shall be factory drilled for fasteners. Secure nameplates to equipment or nearby wall using AISI Type 304 stainless steel fasteners. The locations of each nameplate shall be coordinated with the Owner and approved by the Owner before their installation.

C. The Contractor shall obtain the Engineer's approval for the nameplate information for each equipment item described in the Division 11 Sections before ordering these nameplates from the manufacturer.

2.05 PRESSURE GAUGE ASSEMBLIES – PUMPING UNITS

A. General: The Contractor shall provide a pressure gauge assembly, as specified in Section 15125, Piping Appurtenances, on the suction and discharge piping of the pumping units specified in the Division 11 Sections. The intent of the Drawings is not to show the locations of every pumping unit pressure gauge. Rather, the Contractor shall mount each pressure gauge as close to the pump suction and discharge connections as possible, but so as not to impede the operation and maintenance of the pressure gauge assembly, pumping unit, and valves installed on the pumping unit suction and discharge piping. Coordinate the location of all pressure gauge assemblies with the Engineer and Owner before installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall install equipment, slabs, walls level and plumb, parallel and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

C. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

D. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

E. Provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use Alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings or guards, or without creating safety hazards at installed equipment elevations.
2. The Contractor shall exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. The Contractor shall extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

F. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

G. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade), as possible. In such an instance, the Contractor shall obtain the Engineer's approval for this mounting location before installing that piece of equipment in the field.

H. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

3.02 FIELD TESTING

A. General: The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and

startup tests as specified in the Division 11 Sections and the final mechanical performance test specified in this Section. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Sections regarding equipment shop testing requirements.

B. The Contractor shall adhere to the following requirements regarding the field testing to be provided for this project:

1. The service representative shall be employed by the manufacturer of the equipment specified at the time field testing is being performed. The service representative shall be authorized by the factory to perform the field testing specified in Division 11, Equipment. Upon request by the Engineer, the Contractor shall submit a letter from a company officer of the equipment manufacturer stating that the service representative performing the field testing is authorized by the manufacturer.
2. Before scheduling each field test with the equipment manufacturer, the Contractor shall coordinate with the Owner and Engineer to obtain a list of dates that both parties would be available to attend the testing. The Contractor shall notify the Owner and Engineer of the field testing dates no less than 14 calendar days before the date of the field test.
3. If directed by the Engineer, the Contractor shall perform a second pre-startup and/or startup test, in accordance with the procedures specified in the Division 11 Sections, at no additional cost to the Owner if the original pre-startup and/or startup test did not pass because of any work that was deemed by the Engineer to be non-compliant with the Contract Documents and/or manufacturer's recommendations.
4. The Contractor shall only perform startup testing after the Contractor has reached Substantial Completion for the project as defined in the Agreement and General Conditions.
5. The Contractor shall furnish, install, and remove any temporary piping, valves, appurtenances, and equipment necessary to perform the pre-startup and startup testing to the Engineer's satisfaction.
6. All field testing shall be performed Monday through Friday at the project site, unless otherwise approved by the Owner.
7. The duration that the manufacturer's representative is required to be onsite to perform the pre-startup and startup training is specified in Table 11000-1, Equipment Testing and Training Requirements.

C. Operating Costs

1. Costs for Pre-startup and Startup Testing: The Contractor shall include in the Contract Price the following operating costs for satisfactorily

completing the Initial Mechanical Performance Tests on equipment being tested:

a. Lubricating grease and oils.
b. All filters, seals, and gaskets required, in addition to the spare parts.
c. Such other materials or utilities not specifically identified in this Section but required to conduct the pre-startup and startup testing.
d. Portable diesel power generation sets and diesel fuel as needed for lighting, portable tools, and furnishing electrical to any temporary pumping units used to transfer potable water to each treatment or storage structure for startup testing.

2. Costs for Final Mechanical Performance Tests: The Owner will pay for the operating costs for the Final Mechanical Performance Test, except for the Contractor's personnel needed to perform and supervise this testing as specified in this Section.

D. The intent of the field testing for each equipment item specified in the Division 11 Sections is provided in this Section. If the individual equipment field testing procedures specified in the Division 11 Sections are not sufficient to obtain a Manufacturer's Certification or to demonstrate compliance with the Contract Documents, the Contractor shall perform these additional field test procedures at no additional cost to the Owner.

1. Pre-startup Testing: Upon the Contractor's completion of the installation and adjustment of the equipment; the Contractor, with his own forces and with the manufacturer's representative(s), shall demonstrate to the Engineer's satisfaction that the equipment has been furnished and installed in accordance with the Contract Documents and the manufacturer's recommendations.

a. The Contractor shall repair any equipment items that does not pass the pre-startup test, as identified by the Engineer and/or manufacturer's representative, to the satisfaction of the Engineer before performing the startup testing for that equipment.

2. Startup Testing: Upon successful completion of the pre-startup testing, the Contractor shall demonstrate that the mechanical performance and controls of each equipment item, when operated in accordance with the design intent indicated by the Contract Documents, are satisfactory to the Owner and Engineer.

a. Startup testing shall be performed with each equipment item and associated treatment structure simulated under similar operating conditions as the final mechanical performance testing specified in this Section. For equipment that will operate while being submerged as shown on the Drawings, the Contractor shall fill the respective treatment structure to its maximum water surface with Owner-provided potable water and perform startup testing while that equipment is submerged. The Contractor shall not use wastewater to fill any treatment structures for startup testing.

b. After the startup testing procedures specified in the Division 11 Sections have been completed to the satisfaction of the Engineer, the Contractor shall operate that equipment for one successful continuous 72-hour period without assistance from the Owner as a condition of startup testing. If the equipment needs to be taken out of service for repair during this 72-hour period because it not operating in accordance with the intent of the Contract Documents, this operating period shall cease. A new operating period will not begin until the equipment has been operating in accordance with the Contract Documents and manufacturer's recommendations for at least 72 consecutive hours. The Contractor shall furnish any additional supervision or provisions necessary to verify that each equipment item was successfully operated during this 72-hour operating period.

c. Upon completion of the startup test, the Contractor shall dewater each treatment and storage structure in accordance with local and State regulations and in a manner that is satisfactory to the Owner and Engineer.

3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of the equipment specified in the Division 11 Sections once the following conditions have been satisfied:

a. The Contractor has successfully completed the pre-startup and startup testing requirements specified in the Division 11 Sections.

b. The Contractor has performed the training services specified in this Section.

c. The Contractor has procured all of the required permits for each building and treatment structure within the project site.

d. The Engineer has received and approved all of the manufacturer's certifications of compliance, warranties, and O&M manuals for all required items as specified in the Contract Documents.

e. The intent of the final mechanical performance test is for the entire facility to be operated by the Owner for a continuous 30-day period while the facility is receiving and treating raw sewage. During this 30-day testing period the Contractor shall furnish personnel who shall be on-site as needed and available at all times 24 hours per day during the final mechanical performance test. Personnel shall be competent in the troubleshooting and repair of the equipment and related electrical and mechanical systems specified in the Contract Documents. The Contractor's electricians and mechanical technicians shall be on-site as needed (minimum 8 hours/week) and available 24 hours per day to assist with this testing. If the final mechanical performance testing needs to be stopped and suspended due to equipment not operating in accordance with the design intent of the Contract Documents as determined by the Engineer, the following conditions shall apply:

   (1) The Contractor shall repair and troubleshoot these items immediately at no additional cost to the Owner.
   (2) The 30-day period for the final mechanical performance testing will start over (i.e., be reset to zero hours).

f. Upon restarting the final mechanical performance testing, the Contractor shall furnish the appropriate personnel defined above on-site as needed and available (minimum 8 hours/week) for 24 hours per day during the 30-day period at no additional cost to the Owner even though the total duration of the final mechanical performance testing (including restarts), may exceed 30 days.

g. The final mechanical performance test shall end when the Engineer determines that all of the equipment and related systems are operating in accordance with the design intent of the Contract Documents and all deficiencies that hinder the normal day-to-day operation of the facility have been corrected to the satisfaction of the Engineer. The Engineer shall notify the Contractor in writing when the final mechanical performance testing has been successfully completed.

3.03 TRAINING SERVICES

A. Upon completion of the pre-startup and startup testing and before the final mechanical performance testing, the manufacturer of the equipment specified in the Division 11, 13, and 15 Sections shall provide an authorized representative to train the Owner's personnel in the operation and maintenance of the equipment.

The representative shall provide additional onsite startup and troubleshooting services during this training upon request by the Engineer or Owner while performing these training services. The duration of the training services for each equipment items are specified in Table 11000-1, Equipment Testing and Training Requirements. Requirements for Training are specified in Section 01820, Training.

3.04 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, as required in Table 11000-1,Equipment Testing and training Requirements, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

Table 11000-1 Equipment Testing and Training Requirements

(Hours below stipulate the duration the manufacturer's representative is required be on site to perform the required pre-startup and starting testing, final mechanical performance testing, and training services specified in the listed Sections. See Note 1.)

Section	Equipment Name	Pre-Startup Testing (3)	Startup Testing (3)	Final Mechanical Performance Testing (4)	Training (4)
11214	Vertical Turbine Pumps	8 hours	8 hours	8 hours	4 hours
11260	Chemical Metering Pumps and Skid Systems	8 hours	8 hours	8 hours	4 hours
11331	Internally Fed Rotating Drum Screen with Shaftless Spiral Conveyor/Compactor	16 hours	16 hours	16 hours	8 hours
11355	End Suction Non-Clog Centrifugal Pumps	16 hours	16 hours	16 hours	16 hours
11356	Progressing Cavity Pumps	8 hours	8 hours	8 hours	8 hours
11378	Positive Displacement Blowers	8 hours	8 hours	4 hours	4 hours
11535	Submersible Non-Clog Centrifugal Pumps	16 hours	16 hours	16 hours	16 hours
11550	Coarse-Bubble Diffused-Aeration System	8 hours	8 hours	4 hours	4 hours
11551	Fine-Bubble Diffused-Aeration System	8 hours	8 hours	4 hours	4 hours
11600	Laboratory Equipment	8 hours	8 hours	4 hours	8 hours
11605	Composite Sampling Equipment	2 hours	4 hours	4 hours	4 hours
15065	Fabricated Gates	4 hours	4 hours	8 hours	4 hours

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

_____ Installed in accordance with Manufacturer's recommendations.

_____ Inspected, checked, and adjusted.

_____ Serviced with proper initial lubricants.

_____ Electrical and mechanical connection meet quality and safety standards.

_____ All applicable safety equipment has been properly installed.

_____ System has been performance tested and meets or exceeds specified performance requirements (when complete system of one manufacturer).

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment, and (iii) authorize the make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION TESTING AND INSTRUCTION

OWNER

PROJECT

CONTRACT NO.

Jones Edmunds No.

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with Serial No.)

Installed for the subject project has have been installed in a satisfactory manner, has have been satisfactorily tested, is/are ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the units on Date:

_____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGEMENT OF MANUFACTURER'S INSTRUCTION

I/We the undersigned, authorized representatives of the _____ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and am/are prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

END OF SECTION

SECTION 11214
VERTICAL TURBINE PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install, place in operation, and field test vertical turbine pumps, motors, adjustable-speed drives, and coordinated speed-control systems as specified in these Specifications.

B. These Specifications are intended to give a general description of what is required but do not cover all details which will vary with the requirements of the equipment application. The Specifications are, however, intended to cover the furnishing, shop testing, delivery, complete installation, and field testing of all materials, equipment, and appurtenances for the complete pumping systems as specified in this Section, whether specifically mentioned in these Specifications or not.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each 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 electronically, at as large a scale as practical. 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. Complete master wiring diagrams, elementary or control schematics including coordination with other electrical control devices such as the pump control system, and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Provide suitable outline

drawings showing such details as are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable. Refer to the Electrical and Instrumentation Drawings for the control wiring diagrams for the pump motors.

5. A complete total bill of materials of all equipment.
6. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Article 1.09, with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.
7. Complete motor data.
8. A torsional mass elastic system analysis for each variable-speed pumping system.
9. A statement of compliance with the turbine reverse run-away speed requirements listed in Article 2.01.

C. Test Reports to be Submitted:

1. Description of test procedures and equipment.
2. Copies of all test results, as specified in Parts 2 and 3 of this Section.

D. Complete installation, operating, and maintenance instructions shall be furnished for all equipment specified in this Section in accordance with the General Conditions and Division 1, General Requirements.

E. The Contractor shall submit the manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1, General Requirements.

F. If it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Bearing Manufacturers Association (ABMA)

B. American Gear Manufacturers Association (AGMA)

C. American Institute of Steel Construction (AISC)

D. American Iron and Steel Institute (AISI)

E. American Society of Mechanical Engineers (ASME)

1. ASME B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.

F. American Society for Testing Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
3. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
5. ASTM A582/A582M—Standard Specification for Free-Machining Stainless Steel Bars.

G. American Water Works Association (AWWA)

H. American Welding Society (AWS)

I. Hydraulic Institute (HI)

1. HI Test Standards, Vertical Pumps

J. Institute of Electrical and Electronics Engineers (IEEE)

K. National Electrical Code (NEC)

L. National Electrical Manufacturers Association (NEMA)

M. Occupational Safety and Health Administration (OSHA)

N. Steel Structures Painting Council (SSPC)

O. Underwriters Laboratories, Inc. (UL)

1.04 QUALITY ASSURANCE

A. Qualifications

1. To ensure unity of responsibility, the pumps, motors, 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 systems including pumps, motors, adjustable-speed drives, and controls as specified.

2. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by a competent organization having long experience in the production of such equipment. 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, except as otherwise specified in this Section.
3. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.
4. The manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components of the assembled pumping unit to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range. The design shall include all supporting sole plates and fabricated steel base plate for mounting the units to the existing wet well openings as required.
5. The manufacturer shall perform lateral and torsional critical speed analyses to identify and ensure that (a) the first lateral critical speed shall be at least 25% above the maximum pump speed, (b) the first torsional critical speed shall be at least 25% above the maximum pump speed, and that (c) any blade-excited resonant frequency shall be no closer than plus or minus 25% of the natural frequency of any part of the installed assembled pumping unit. Before manufacture, a statement indicating that the required analyses have been made and that the specified limitations will be met must be forwarded to the Engineer.

B. Services of Manufacturer's Representative

1. The equipment manufacturer shall furnish the services of a competent and experienced factory representative who has complete knowledge of proper installation, operation, and maintenance of the equipment for not less than two 8-hour days (exclusive of travel time), in two separate visits, to inspect the installed equipment, perform an initial test run, conduct final performance testing, and provide operating and maintenance instructions to the plant personnel.

    a. The first visit shall be for checking and inspecting the equipment after it is installed.
    b. The second visit shall be to perform the initial test run, conduct final performance testing, and provide operator training.

2. At least one of the 2 days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled with the Owner at least 10 days in advance and shall take place before plant start-up and acceptance by the Owner. The final approved copies of operation and maintenance manuals must have been delivered to the Engineer before the instruction period is scheduled with the Owner.

3. The Contractor shall videotape, in a digital format, all training provided by the manufacturer's representative. The videotape(s) or other electronic media shall become the property of the Owner.

4. If there are difficulties in operating the equipment due to the manufacturer's fabrication or the Contractor's installation, additional service shall be provided at no change in Contract Price or Time.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All equipment supplied under this Section shall be warranted for 1 year by the Contractor and the manufacturer. The Warranty period shall begin as outlined in the General Conditions and Division 1, General Requirements.

C. 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 and the unit(s) restored to service at no expense to the Owner.

D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

E. Refer to Division 1, General Requirements, for additional warranty requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in the Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All equipment and 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.

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.

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 before shipment, and proper care shall be taken to protect parts from water entering them during shipment, storage, and handling.

G. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.07 QUALIFICATIONS

A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization which is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and shall operate satisfactorily when installed.

B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

C. These Specifications are intended to give a general description of what is required but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. The Specifications are, however, intended to cover the furnishing, delivery, installation, field testing, and field calibration of all materials and apparatus as required. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract price or Time.

1.08 TESTING REQUIREMENTS

A. Testing shall be performed as specified in Part 2 and Part 3 of this Section.

1.09 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the following spare parts in accordance with the requirements of Section 01600, Materials and Equipment:

   a. One set of packing, including split gland, nuts, bolts, and lantern ring.
   b. One spare lower bearing, including grease seal, gasket, and slinger or equivalent for each model of pumps.
   c. One set of impeller shaft keys, dowels, and pins,
   d. One set of shaft sleeves and line shaft bearings.
   e. One complete set of gaskets and O-rings.
   f. One spare set of bowl bearings.

B. Special Tools

1. The Contractor shall furnish one set of all special tools required for normal operation and maintenance of the equipment.
2. Tools shall be furnished in a suitable steel case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.

1.10 SYSTEM DESCRIPTION

A. All of the equipment included in this Section is intended to be standard for vertical turbine pump applications.

B. The vertical turbine pumps shall be as described in Table 11214-1 of these Specifications.

C. Pumps shall be capable of successful operation without motor overload and without vibration at run-out.

1.11 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. The manufacturer shall provide O&M manuals for the specific equipment with appropriate model numbers, pump curves, and motor data specific for this project. O&M manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The pumping units required under this Section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be designed and proportioned 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. Pumps and drives shall be rigidly and accurately anchored into position. All necessary bolts, nuts, and washers shall be furnished by the Contractor. Anchor bolts, nuts, and washers shall be ASTM A276/A276M Type 302 stainless steel.

C. Each equipment item shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. At a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed, and all other pertinent data. At a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles, and power and service factors. Nameplate information for the adjustable-speed drives shall include the manufacturer's name and serial number, input speed, voltage, current and frequency, and horsepower at full load.

D. 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. The maximum reverse run-away speed shall not exceed 180% of the design pump maximum operating speed. A statement of compliance with this requirement must be furnished with the Shop Drawing submittal.

E. All working parts of the pumps, motors, and adjustable-speed drives, such as bearings, wearing rings, shaft, sleeves, etc., shall be standard dimensions built to limit gauges or formed to templates so that parts will be interchangeable between like units and so that the Owner may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines. All parts shall be properly stamped for identification and location in the machines as shown on the assembly drawings in the O&M Manuals furnished.

F. The nameplate ratings of the motors shall not be exceeded nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve at maximum speed.

G. All rotating parts of the specified equipment shall be mechanically and hydraulically balanced so as to operate throughout the required range without

excessive end thrust, vibration, and noise. The maximum allowable vibration measured at the top motor bearing for vertical pumps shall not exceed the maximum peak to peak amplitude as set forth in the Hydraulic Institute Standards, latest edition. The noise level of motors, corrected for background sound, shall not exceed 80 dBA when measured at a horizontal distance of 5 feet from the equipment being tested, at a height of 5 feet above floor level, under free field conditions, when operating on utility power. Failure to meet these criteria shall be sufficient cause to reject the equipment.

H. Mechanical equipment, including drives and electric motors, shall be supplied and installed in accordance with applicable OSHA regulations. Stainless steel guards shall be installed on all rotation assemblies.

I. All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards. Fittings shall be buttonhead type. Lubrication fittings shall be mounted together wherever possible. Pressure grease-lubricated fittings shall be the "Zerk Hydraulic" type or the "Alemite" type. Housings of grease-lubricated bearings shall be automatically exhausted to the atmosphere to prevent excessive greasing.

2.02 PUMPS

A. General

1. The pumps shall be of the vertical turbine multistage type designed to pump treated, non-potable wastewater.
2. The pumps shall be as manufactured by the Peerless Pump Company, Indianapolis, IN; Flowserve Pump Division, Taneytown, MD; Fairbanks Morse Pump, Kansas City, Kansas; or equal pumps meeting the detailed hydraulic, efficiency, and mechanical requirements specified in this Section.

B. Performance Requirements

1. When operating at the maximum output speed of the motor, each pump shall have a characteristic performance curve which meets all the minimum conditions listed in Table 11214-1. The pumps, drive motors, and adjustable-speed drives shall be capable of operating satisfactorily under the full range of conditions as defined by Table 11214-1. The intermediate pump capacity, head, and efficiency defined in Table 11214-1 shall be the "design point." *Pump efficiency* as defined in this Section shall be bowl efficiency.
2. Each pump shall be capable of continuous adjustable-speed operation over the speed range from 50% to 100% of pump design speed. There shall be

no significant change in vibration and noise level over the entire listed range of speed and flow of the pumping system.

3. Maximum motor speeds shall not exceed those listed in Table 11214-1 to satisfy the specified hydraulic duty requirements. The pump "design speeds" shall be the maximum output speed of the motor furnished, when operating at the pump "Intermediate" capacity and head at 60 Hertz on utility power (full motor speed). All pumps shall have identical impeller sizes.
4. With the pumping units operating at full motor speed, the maximum brake horsepower required by the pumps shall not exceed the maximum horsepower listed in Table 11214-1. If the pumping units require more than the maximum horsepower listed in Table 11214-1 at the motor output shaft at any full motor speed operation point between Primary and Secondary discharge head, they will be rejected.
5. The pumping unit shall not require a NPSH value greater than that listed at the primary operating conditions in Table 11214-1. The minimum water level in the wet well shall be as shown on the Drawings.

C. Pump Construction

1. The connection of the vertical hollow shaft motor to the two-piece head shaft of the pump shall be made with a flanged coupling that shall be suitably sized to transmit the torque and thrust requirements of the pump.
2. The discharge head shall be of the base type of cast iron construction ASTM A36/A36M. The discharge head and discharge connection shall not be less than the diameter listed in Table 11214-1. The discharge connection shall be provided with a 125-pound flat-faced flange. The packing gland access openings shall be of adequate size to allow for packing adjustment and replacement and shall be protected by expanded metal screens constructed of Type 316 stainless steel.
3. Incorporated in the fabrication of the discharge head shall be a suitable pump support base not less than 1-1/8 inches in thickness of standard ASME B16 B2 flanged dimensions to support both the pump and the motor. The baseplate of the discharge head shall be supported on a fabricated steel soleplate furnished by the manufacturer. The baseplate flange bolting shall be in accordance with the requirements of ASME B16 B2.
4. The discharge head will be fitted with a packed type stuffing box. Stuffing boxes shall be supplied complete with bronze split gland, 316 stainless steel studs, and nuts and bronze lantern rings.
5. The pump head shaft shall be constructed of ASTM A582/A582M-416 Stainless Steel Alloy. Shaft diameter shall be determined by the former AWWA Standard for Vertical Turbine Pumps – Line Shaft and Submersible Types, ANSI/AWWA E101, Section A4.1.5, but in no case be less than the diameter shown in Table 11214-1.

6. The pump column shall be constructed of steel pipe in accordance with ASTM A36/A36M or ASTM A53/A53M, not less than the diameter listed in Table 11214-1. The column shall not be less than Schedule 30 and shall be flanged at each end. The flanges shall mate with each other, the pump bowl assembly, and the discharge head with rabbetted fits to ensure correct alignment. Bolts used to attach column flanges shall be constructed of 316 stainless steel.
7. The pump line shaft shall be constructed of ASTM A582/A582M-416 Stainless Steel Alloy and its diameter determined as described in 2.02 C.6 above but in no case shall it be less than the minimum diameter listed in Table 11214-1.
8. The line shaft couplings shall be of the threaded type constructed of ASTM A582/A582M 316 Stainless Steel Alloy and of such design that no threaded parts which could cause "galling" are interconnected. Alternate constructions must be of a design acceptable to the Engineer.
9. The pump impellers shall be of the enclosed type constructed of AM2000 bronze, or aluminum-bronze or equal. The impellers shall be attached to the shaft by an ASTM A582/A582M-416 stainless steel key or lock collet for positive driving of the impeller by the shaft.
10. The pump bowls shall be constructed of ASTM A48/A48M Class 30 cast iron having a minimum tensile strength of 30,000 psi. The pump bowls shall be of sufficient thickness to withstand stresses and strains at full operating pressure. The bowls shall be subjected to a hydrostatic test 150% of that specified at the intermediate design conditions in Table 11214-1. The bowls shall be designed and manufactured with open and smooth water passages to ensure efficient, reliable operation.
11. The intermediate bowl bearings shall be constructed of bronze/rubber.
12. Pump Coating: All portions of the column and pump discharge head not exposed to view, except for the interior of the bowls, shall have an interior and an exterior coating of for Zinc+MIO blend urethane/Cycloaliphatic amine epoxy of 14.5 to 19.5 mils dry thickness, compatible with the pump service. Surface preparation shall be in accordance with the coating manufacturer's recommendations and Division 9, Finishes.

D. Pump Discharge Gauges: The Contractor shall furnish and install for each pump in tapped holes in the discharge piping to accommodate suction and discharge gauges which shall be supplied by the Contractor and as specified under Section 15125, Piping Appurtenances, or as recommended by the pump manufacturer.

2.03 MOTORS

A. Motors shall be of the vertical, hollow-shaft squirrel-cage induction type. Motor frames shall be TEFC with epoxy-encapsulated windings. Motors shall be provided with ball type centrifugal non-reverse ratchets.

B. Motors shall be designed to accept all upthrust loads imposed by the pump during starting and running.

C. Motors shall be built in accordance with the latest NEMA, IEEE, ASME, and AFBMA standards where applicable.

D. Motors shall conform to all requirements specified and with the specifications for motors included in Section 16150, Motors.

E. Motors supplied for the pumps shall be specifically designed for inverter duty on a PWM-type power source. The motors shall be compatible with the pumps and adjustable-speed drives provided by the manufacturers.

F. Motors shall include motor space heaters at 120VAC and winding thermostats.

G. Motors shall be manufactured by U.S. Motors

2.04 SHOP PAINTING

A. Before exposure to weather and before 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 in accordance with Division 9, Finishes. Primer shall be compatible with the finish paint specified in Section 09900, Painting and Coating.

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.

2.05 SHOP TESTING

A. The Engineer shall have the right to inspect, test, or witness tests of all materials or equipment to be furnished under this Section before their shipment from the point of manufacture.

B. The Engineer shall be notified in writing before initial shipment in ample time so that arrangements can be made for inspection.

C. Factory Pump Tests

1. Witnessed factory testing in accordance with the standards of the Hydraulic Institute shall be required for all pumps.
2. Certified pump performance curves shall be submitted, including head, capacity, brake horsepower, and pump efficiency for each pump supplied. Certified data shall be provided to verify the NPSH required by the pumps at the primary operating point listed in Table 11214-1.
3. In lieu of testing with all job equipment, job pump bowls may be tested with a laboratory column pipe and discharge head similar in size to that furnished for final installation. The length of column pipe will be the same as will be required to set the bowl in the field.
4. All pumps shall be tested at full speed and complete staging through the specified range of flow and head/capacity/efficiency curves plotted at maximum output speed. During each test the pump shall be run at each head condition for enough time to accurately determine discharge, head, power input, and efficiency.
5. If any pump tested fails to meet any Specification requirement, it will be modified until it meets all Specification requirements. If any pump tested fails to meet the efficiency requirements at any of the flow or head conditions listed in Table 11214-1 and all reasonable attempts to correct the inefficiency are unsuccessful, the pump or pumps shall be replaced with a unit or units that meet the specified requirements.

D. The Contractor shall include in his price a sum sufficient to reimburse the Engineer for all reasonable expenses that the Engineer will incur to witness the test. *Expenses* are defined here as all direct expenses such as auto and rental car expenses, air fare, lodging, meals, and miscellaneous costs plus the Engineer's time billed at an average in accordance with Div 01, General Requirements. The Engineer's time shall include the round-trip travel time to and from the factory shop. The sum shall include repetitive visits, if required, and shall be deducted from payments due to the Contractor by the Owner.

E. Pump motor tests as specified in Section 16150, Motors, shall be submitted for approval by the Engineer before shipping.

F. Adjustable-speed drives shall be factory tested in accordance with the requirements of Section 16050, Electrical—General Provisions.

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 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 FIELD PAINTING

A. Field painting is specified in Division 9, Finishes. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to ensure compatibility.

B. All nameplates shall be properly protected during painting.

3.03 FIELD TESTING

A. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Field Pump Tests

1. After installation, the Contractor shall demonstrate to the Owner and Engineer that the installed equipment can perform satisfactorily under actual field conditions. The pumps shall be field tested to verify mechanical integrity and soundness of construction, installation, and operation.
2. After the equipment has been operated long enough to make all desirable corrections and adjustments, each pumping unit and all associated equipment shall be field tested to determine that operation is satisfactory; free from excessive vibration, leaks, and noise; and in compliance with these Specifications.
3. Noise and vibration tests shall be conducted in conformance with the Hydraulics Institute Test Codes and OSHA Standards for Occupational Noise Exposure. Maximum allowable noise and vibration levels shall not exceed the limits specified in Paragraph 2.01G. Vibration shall be measured by an IRD Model 330 Vibration Analyzer or equal. The actual natural frequency of the installed pumping units will be verified using industry-accepted procedures.
4. If the pump performance, including vibration levels or natural frequency, does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps which satisfy the

conditions specified and retested. A 24-hour operating period of the pumps will be required before acceptance.

5. All pump operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.
6. The Contractor shall furnish all power, water, facilities, labor, materials, supplies, and test instruments required to conduct field test.
7. Upon completion of satisfactory testing of the equipment, the Contractor shall deliver to the Engineer reports as specified in Division 1, General Requirements.

C. Field Electric Control System Tests

1. The Contractor shall test operate each adjustable-speed drive and electric control system for proper functioning before the pump mechanical test. The control system shall be checked out using simulated operating signals in accordance with the adjustable-speed drive manufacturer's recommendations.
2. Check all drives for correct clearances, alignment, and lubrication before start-up in accordance with the respective manufacturer's instructions.

D. Field Motor Tests

1. Megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, notify the Engineer. Do not energize the motor.
2. Check all motors for correct clearances and alignment and for correct lubrication in accordance with the manufacturer's instructions. Check direction of rotation of all motors and reverse connections if necessary.
3. Perform all testing requirements as specified in Division 16, Electrical.

E. Field Alarm System Testing

1. Check each alarm and detection device for proper operation.

TABLE 11214-1
PUMPING UNIT DESIGN REQUIREMENTS

Item/Design Conditions	Reclaimed Transfer Pumps (VSD)
Maximum Motor Speed (rpm)	1,800
Motor to be Supplied (HP) (maximum)	100
Column and Discharge Size (inches)	8
Minimum Pump Shut-Off Head at Design Speed (feet)	380
Minimum Pump Best Efficiency Point (%)	84.0
Primary TDH (feet)	250
Minimum Capacity at Primary TDH (gpm)	1,000
Minimum Pump Efficiency at Primary TDH (%)	80.0
Maximum NPSHR at Primary TDH (feet)	22.0
Pump Model Used for Basis of Design	Peerless M12MB/MC

END OF SECTION

SECTION 11260
CHEMICAL METERING PUMPS AND SKID SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes provisions for the complete installation of Chemical Metering Pump Skids and appurtenances as shown in the Contract Drawings and as specified herein.

1.02 SUBMITTALS

Submit to the Engineer, in accordance with Section 01330, Submittals and Acceptance, copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

A. Shop drawings and product data for the products of this Section as specified elsewhere. Include detailed schematic of equipment, piping, controls, etc.

B. Manufacturer's certificates.

C. Operation and maintenance manuals and manufacturer's instructions in accordance with Section 01730, Cutting, Coring, and Patching.

D. Submit a cross-sectional sample of pipe joining practices for inspection. Only those manufacturers providing acceptable samples will be considered.

E. Submit 5 references where similar chemical metering systems are being used for 12.5% sodium hypochlorite or carbon feed application.

F. Submit a copy of proposed manufacturer's guarantee and local parts/service center information.

1.03 REFERENCES

Design, manufacturing and assembly of elements of the products herein specified shall be in accordance with the standards of the below listed organizations:

A. American Society for Testing Materials (ASTM)
B. American Water Works Association (AWWA)
C. Hydraulic Institute Standards
D. NSF 61

Where reference is made to a standard of one of the above, or other organizations, the version of the standard in effect at the time of bid opening shall apply.

1.04 SYSTEM DESCRIPTION

A. The work under this Section includes the furnishing of all labor, materials, equipment and supervision for the manufacture and installation of skid-mounted chemical metering systems suitable for the application of 12.5% sodium hypochlorite and viscous glycerin-based carbon solution as shown on the Drawings and specified herein.

B. This Section provides requirements for a triplex sodium hypochlorite system and a triplex glycerin-based carbon feed system. The material and product specifications contained herein apply to both systems, except where otherwise noted.

1.05 PERFORMANCE REQUIREMENTS OR CONDITIONS

A. Sodium Hypochlorite (NaOCl)

1. Concentration: 12.5 Trade Percent.
2. Specific Gravity: 1.1 to 1.2.
3. Ambient Temperature.

B. Glycerin-Based Carbon Solution

1. Bulk Density: 10.22 lbs/gal.
2. Specific Gravity: 1.225.
3. Viscosity: 50 cPs
4. Ambient Temperature.

1.06 QUALITY ASSURANCE

A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practice and methods, and shall operate satisfactorily when installed.

B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified herein for a minimum of five (5) years.

C. These Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover

the furnishing, delivery, installation, field testing and field calibration of all materials and apparatus as required. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract Price or Time.

D. The manufacturer must have a service center with trained technicians authorized to make repairs to all components of the chemical feed system. This supplier shall be responsible for providing all equipment, accessories, spare parts, documentation, and installation supervision required for a complete and operational chemical feed system. Systems assembled by second party fabricators, equipment distributors/representatives; integrators or contractors shall not be acceptable.

1.07 DELIVERY AND STORAGE

A. All equipment delivered and placed in storage shall be stored with protection from the weather, humidity, and temperature variations; dirt and dust; or other contaminants in accordance with the manufacturer's recommendations.

1.08 SPARE PARTS

The Contractor shall furnish the following spare parts in clearly identified containers for each chemical metering skid:

A. Two maintenance kits for each chemical metering pump. Maintenance kits shall include but not be limited to diaphragm, suction and discharge check valve assemblies, gaskets, and o-rings.

B. Two maintenance kits for each pressure relief valve.

C. Two maintenance kits for each back pressure valve.

D. One spare bladder for each pulsation dampener.

E. One spare true union ball valve.

F. One parts list/instruction sheet for all serviceable components.

G. All parts shall be in one box labeled with the Skid ID Information. The spare parts kit shall include all parts required for 2 years of normal maintenance. A packing list, instruction sheet, and parts list shall be provided for all serviceable items.

1.09 WARRANTY

A. The system manufacturer shall provide a 2-year warranty for the metering pumps and skid material/construction, and skid mounted equipment, piping and valves, including, but not limited to, pumps, motors, valves, pulsation dampeners, meters, controls, piping, and fittings. The warranty shall also cover all material and moving parts of the metering pumps.

PART 2 PRODUCTS

2.01 MANUFACTURER

The Chemical Metering Pump Skid manufacturer shall be the following or equal:

A. Blue Planet Environmental Systems, Inc., Florida.
B. Guardian Equipment, Inc., Florida.
C. Or Engineer-Approved Equal.

2.02 MANUFACTURED UNITS

A. The chemical metering systems shall be completely self-contained and designed to safely feed metered amounts of chemical: 12.5% sodium hypochlorite or viscous glycerin-based carbon solution. Each chemical metering skid shall include multiple identical chemical metering pumps and accessories to offer complete redundancy; two pumps shall be installed on the sodium hypochlorite skid, and three pumps shall be installed on the carbon feed skid. They shall be triplex skids allowing room on the hypochlorite skid for a third pump expansion. The chemical metering skids shall be completely assembled and tested before delivery to the job site. All equipment shall be of materials selected specifically for use with 12.5% sodium hypochlorite or viscous glycerin-based carbon solution, as appropriate.

B. Chemical Metering Pumps

1. Performance Requirements:

	12.5% Sodium Hypochlorite	Viscous Glycerin-Based Carbon Solution
No. Pumps	2	3
Future Spare	1	0
Pump Capacity, Each	0.1-5.0 GPH	1.04-2.08 GPH
Total Capacity (One Unit Out of Service)	10.0 GPH	4.16 GPH
Outlet Pressure	20 psi max	50 psi max

2. Reference codes and standards: Pumps shall comply with the latest editions of the following codes and standards:

   a. UL Standard 778.
   b. Hydraulic Institute Standards.
   c. National Electric Code.

3. Definitions:

   a. Electronic metering pump – A positive displacement diaphragm metering pump in which the diaphragm is actuated by an electromagnetic solenoid which is in turn controlled by an electronic circuit.

4. General:

   a. Output volume shall be adjustable while pump is in operation.
   b. Weight of pump as installed shall not exceed 22 pounds.
   c. Pump shall fit within a rectangular volume 10.5 inches long by 6 inches wide by 11 inches high.

5. Materials of Construction:

   a. Pump housing shall be of chemically resistant glass fiber reinforced thermoplastic.
   b. All exposed fasteners shall be stainless steel.
   c. Liquid end materials shall be PVC / Teflon / Ceramic / Fluoroelastomer.

6. The chemical metering pumps shall be manufactured by Prominent, Gamma/XL Series or approved equal.

C. Chemical Metering Skid

1. The chemical metering skids shall be constructed from solid white rigid PVC sheet with a minimum thickness of 1/2 inch. The skid shall be self-supporting and all components of the chemical metering system shall be contained within the skid. Pedestals shall be provided to elevate the skid base to a height not to exceed 12 inches. The skids shall be manufactured using thermal welding technology, bolted construction is not acceptable.
2. For each chemical metering pump the piping system shall include one pressure relief valve; one pulsation dampener; one diaphragm protected pressure gauge; one back pressure valve; one flushing inlet; one flushing outlet, one anti-siphon device, and all required piping, valves, and supports. Piping shall include isolation valves and unions for all serviceable components. The chemical supply piping shall allow for dual

chemical inlets with y-strainers and a calibration column shall be provided and designed for use with any of the metering pumps. The discharge piping shall allow for each pump to serve individual loads or a common load with backup.

3. All piping shall be schedule 80 PVC bearing the NSF61 potable water logo with assembly performed in a controlled shop environment by the skid manufacturer. All pipes shall be squarely cut on precision equipment with the ends chamfered and de-burred. 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 either 12.5% sodium hypochlorite or viscous glycerin-based carbon solution, as appropriate, 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.
4. 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 chemical metering skid, bolted or screwed 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.
5. A NEMA 4X terminal box shall be provided on the skid back panel for termination of all power/control wiring. A power outlet with weatherproof cover shall be provided for the metering pump power cords and shall be pre-wired to the terminal junction box.
6. The chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site. Each skid shall include 316 SS mounting brackets.

D. FRP Floor Stand

1. A floor stand shall be provided by the skid manufacturer to elevate the metering skid above the floor. The stand shall be designed to have the liquid end of the metering pumps at a height not to exceed 12 inches from the floor. The stand shall be fabricated from FRP extrusions with adhesive bonded connections.

2.03 ACCESSORIES

A. Magnetic Flow Meter

1. One plastic-bodied magnetic flow meter shall be provided on each of the two pump skids: sodium hypochlorite and chlorine feed. The magnetic flow meter shall include a local LCD display with indication of current flow rate (scaled in gph) and re-settable totalizer (scaled in gallons). The

magnetic flow meter shall include a 4-20 mA output and (2) alarm relays. All magnetic flow meter electrical connections shall be available in the skid mounted NEMA 4X terminal junction box.

B. Calibration Columns

1. A clear PVC calibration column shall be provided in the chemical supply piping. The piping shall be designed for the calibration column to be used with any of the metering pumps. The top of the calibration column shall be vented to the atmosphere by the contractor. Calibration columns may also be used as de-gassing chambers.

C. Pressure Relief Valves

1. Pressure relief valves shall be provided to eliminate excess pressure in the system. The pressure relief valves shall be fully adjustable with PVC bodies, Teflon diaphragm and shall have no metal parts in contact with the chemical.

D. Pulsation Dampeners

1. Gas charged pulsation dampeners shall be provided and sized for a minimum of 90% dampening. Pulsation dampeners shall be PVC with a Viton bladder and include gas charge fitting and pressure gauge. The dampeners shall be installed as close to the metering pump discharge as possible.

E. Diaphragm-Protected Pressure Gauges

1. Pressure gauges of the diaphragm protected type shall be provided for indication of system pressure. Industrial quality liquid filled 316 Stainless Steel gauges shall be utilized and the isolators shall have PVC housings with a Teflon diaphragm and suitable liquid fill.

F. Back Pressure Valves

1. Back pressure valves shall be provided to provide a constant back pressure at the chemical metering pump discharge. The back pressure valves shall be fully adjustable with PVC bodies, Teflon diaphragm and shall have no metal parts in contact with the chemical.

G. Anti-Siphon Device

1. Anti-siphon devices shall be provided for discharge lines.

H. Piping and Valves

1. All piping shall be solvent welded schedule 80 PVC and shall bear the NSF potable water logo.
2. All valves and unions shall be schedule 80 PVC with Viton o-rings. Valves shall be true union type and include built-in handle locking mechanisms. Ball valves for use with chemicals prone to gassing, such as sodium hypochlorite, shall be vented.

2.04 MOTORS AND DRIVERS

A. Pump Drive

1. The pump mechanism shall be totally enclosed with no exposed moving parts.
2. Electronic control module shall be located beneath solenoid and protected by a clear, hinged cover.
3. Average power consumption shall not exceed 48 watts under full speed and maximum pressure conditions.
4. Metering pump shall be capable of pumping a maximum of (q) GPH against a maximum pressure of (p) PSI. (q and p from Table 1).
5. Stroke length shall be adjustable from 20% to 100% by means of a readily accessible keypad.

2.05 CONTROLS

In accordance with Division 13, Special Construction, and Division 16, Electrical:

A. A Nema 4X terminal box shall be provided on the skid back panel for termination of all power/control wiring. A power outlet with weatherproof cover shall be provided for the metering pump power cords and shall be pre-wired to the terminal junction box.

B. Control of pump speed shall be selectable between manual and external.

C. In manual mode, pump speed shall be adjustable from 1 to 360 strokes per minute by means of a readily accessible keypad with digital display.

D. In external analog mode, the pump shall accept a 4 to 20 mA control signal from external equipment and operate at a speed that is proportional to the signal level. The slope and zero offset of the pump's response shall be operator adjustable by means of push buttons.

E. In external digital mode, the pump shall respond to a pulse signal from external equipment such that either one pulse produces n pump strokes (multiply mode) or

n pulses produce one pump stroke (divide mode). In either mode, n shall be operator adjustable from 1 to 999 by means of push buttons.

2.06 SHOP TESTING

A. All pumps shall pass manufacturer's standard performance test.

B. The chemical metering skids shall be assembled and tested by the manufacturer prior to delivery.

2.07 PAINTING

A. Surface preparation, shop painting, field painting and other pertinent detailed painting specifications shall be in accordance with Section 09900, Painting and Coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. The equipment shall be installed in accordance with Section 01600, Materials and Equipment, the instructions of the manufacturer, and the Contract Documents.

B. The installer shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner or Engineer of any discrepancy before performing the work. Each skid shall be stored and installed in accordance with the written instructions of the manufacturer and as indicated on the contract drawings and this specification.

C. A qualified manufacturer's representative shall be retained to supervise the installation, adjustment, and testing of the system. Upon completion of installation, operating tests shall be performed in the presence of the Engineer and the manufacturer's representative. Tests shall assure that the units and appurtenances have been installed correctly, that there is no objectionable leaks, heating, vibration, or noise from any parts, and that all manual and automatic controls function properly.

3.02 TESTING

A. Field tests shall be made in conformance with Sections 01400, Quality Requirements, and 01600, Materials and Equipment.

B. Preliminary field tests shall be made after installation of the Chemical Metering Pump Skid. Final field tests shall demonstrate the following:

1. That the units have been properly installed and are in proper alignment.

2. That the units operate without overheating or overloading of any parts and without objectionable vibration.
3. That there are no mechanical defects in any of the parts.

C. Final acceptance will be dependent upon the satisfactory operation and performance after installation

D. If any deficiencies are revealed during testing, they shall be corrected and the tests shall be repeated at the Contractor's expense. If the Contractor is unable to demonstrate to the satisfaction of the Engineer that the skid units will satisfactorily perform the service required, the units shall be rejected. In such an event, the Contractor shall remove and replace the equipment at the Contractor's expense. The Contractor shall furnish all labor, materials and equipment required for such tests and shall correct any deficiencies noted.

3.03 MANUFACTURER'S SERVICES AND CERTIFICATES(S)

A. Provide manufacturer's (or supplier's) services according to Section 01600, Materials and Equipment. Additional manufacturer's services include:

1. The Contractor shall arrange for the manufacturer to furnish the services of a qualified representative as necessary to check and supervise the equipment installation; to supervise the final acceptance test and the initial operation; and to instruct the Owner's operator in operations, proper maintenance, and repairs. The number of days for each of the manufacturer's services shall be as summarized in Table 1 located in Specification Section 01600, Materials and Equipment. Training shall be in accordance with the requirements specified in Section 01820, Training.
2. The equipment manufacturer shall provide a written report covering his findings and installation approval. The report shall include description of all inspections and any deficiencies noted and shall be mailed directly to the Engineer.

B. Provide for the Owner's consideration a proposal for professional annual maintenance of the chemical metering skid. This proposal shall include the services of a qualified technician to perform maintenance as recommended by the manufacturer. The proposal shall include schedule of services to be performed. This service must include all travel charges, labor and materials required to properly recondition the chemical metering pumps, pressure relief valves, back pressure valves and pulsation dampeners.

C. The maintenance proposal must be provided with the bid for the system manufacturer to be considered.

END OF SECTION

SECTION 11331
INTERNALLY FED ROTATING DRUM SCREEN
WITH SHAFTLESS SPIRAL CONVEYOR/COMPACTOR

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, and incidentals required to provide the internally fed rotating drum screen unit with shaftless spiral conveyor/compactor and associated controls specified herein and shown on the Drawings. This equipment shall consist of two internally fed, perforated plate media rotating drum screens complete with shaftless spiral screw, trough, inlet chute, compaction unit, drive system, support legs, covers, electrical controls, and all other appurtenances required or shown on the Drawings.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

B. Anti-friction Bearing Manufacturers' Association (AFBMA)

1. Bearing Life Specifications.

C. International Electrotechnical Commission (IEC)

1. IEC 60079—Explosive Atmosphere Standards.

D. International Organization for Standardization (ISO)

1. ISO 9001—Quality Management Systems – Requirements.

E. National Electrical Manufacturer's Association (NEMA)

1. Motor Design Standards and Standards for Control Enclosures.

F. Underwriters Laboratories (UL)

1. UL 913—Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

1.03 QUALITY ASSURANCE

A. One manufacturer will be responsible for the supply of the equipment specified herein. The equipment manufacturer shall have no less than 10 years' experience in designing and manufacturing rotating drum screens.

1.04 WARRANTIES

A. All equipment shall be covered against manufacturing defects in materials and workmanship during normal use and service for a period of 1 year from the date of startup.

1.05 QUALITY ASSURANCE

A. Equipment manufacturer shall be ISO 9001 certified.

B. The screen shall be fully assembled and shop tested to confirm fit and function of the screen. A certificate of shop testing shall be supplied in the shipping documents.

C. The screen shall be shipped to the site fully assembled. Some ancillary components may be removed to prevent damage during shipment.

1.06 SUBMITTALS

A. The Manufacturer shall furnish the required number of submittals (and an electronic version if required) to verify compliance with the specification. The submittals shall include:

1. Certified general arrangement drawings showing all important details including materials of construction, dimensions, loads on supporting structures, and anchor bolt locations.
2. A list of all deviations from Drawings and Specifications.
3. Descriptive literature, bulletins, and/or catalogs of the equipment.
4. Complete data on motors and gear reducers.
5. Wiring diagrams and electrical schematics for all control equipment to be furnished.

B. Technical Information

1. Shop drawings, manufacturer's installation drawing, and wiring and schematic drawings.
2. Motor performance data and features.
3. Gear reducer data including service, efficiency, torque rating, and materials of construction.

C. Operation and Maintenance Manuals

1. Equipment operating instructions.
2. Equipment weights and lifting instructions.
3. Installation instructions.
4. Maintenance schedules.
5. Recommended lubricants.
6. Recommended spare parts including wear items.
7. Long-term and short-term storage instructions.

D. Equipment Information

1. Brochures and other descriptive literature.
2. Installation reference list.
3. Manufacturer's warranty.

1.07 SYSTEM DESCRIPTION

A. The screening and compaction equipment shall be designed to function and operate as specified herein.

1. General:

a. Capture debris particles that are 6 millimeters (mm) in cross-section and larger from the raw wastewater flowstream.
b. Automatically operate based on the headworks structure influent pump water levels and adjustable time intervals, and discharge raw screenings (by gravity) into a screenings chute/pipe for discharge to a conveyor compactor that will discharge to a screenings receptacle (dumpster) at the lower level of the headworks structure.
c. Automatically compact, dewater, and wash the screenings and discharge screenings.

1.08 SPARE PARTS

A. The Contractor shall furnish the following spare parts in clearly identified containers, labeled for easy identification without opening the packaging, and suitably protected for long-term storage in a humid environment.

1. General:

a. The Contractor shall furnish initial start-up lubricants plus a 1-year supply of manufacturer specified lubricants for each drive assembly specified herein. The manufacturer shall provide list of approved-for-use alternate sources of lubricants that are equal lubrication products of other manufacturers including specifications such as American Gear Manufacturers Association (AGMA) numbers, viscosity, etc.

2. Screen:

a. Two complete sets of replacement brushes.
b. Eight trunnion wheels (four per screen).
c. One set of radial and thrust bearings and gaskets for each gear reducer.

PART 2 PRODUCTS

2.01 DESIGN REQUIREMENTS

A. General Design Requirements

1.	Total Design Peak Instantaneous Flow (PIF):	1.5 MGD.
2.	Total Design Annual Average Daily Flow (AADF):	0.5 MGD.
3.	Maximum Design Peak Flow per Spiral Cleaned Screen:	2.5 MGD.

MGD = million gallons per day.

B. Screens

1.	Number of Screens:	Two (one duty, one standby)..
2.	Influent Type:	Municipal Wastewater
3.	Influent Solids Concentration (mg/L):	200–400.
4.	Maximum Flow Per Screen (MGD):	2.5.
5.	Screen Media Perforation Size:	6 mm.

6.	Spray Wash Water (gpm/psi)	37/70.
7.	Power Supply (voltage/phase/hertz)	480/3/60.

mg/L = milligrams per liter;
gpm/psi = gallons per minute / pounds per square inch.

C. Shaftless Conveyor/Compactor

1.	Throughput Rate:	70 ft^3/h.
2.	Angle of Inclination (adjustable):	5 degrees.
3.	Trough Length:	9.9 feet.
4.	Solids Discharge Height:	10 feet.
5.	Spray Wash Water (gpm/psi)	8/40–60.

Ft^3/h = cubic feet per hour.

2.02 ACCEPTABLE MANUFACTURERS

A. SAVI Flo-RotoDrum Internally-fed, Perforated Plate Media Rotating Drum Screen Model RTV900X1500 and SPECO Shaftless Spiral Conveyor/Compactor Model CPS200 shall be as supplied by Enviro-Care Company, Gurnee, Illinois.

B. Or Engineer-approved equal.

2.03 EQUIPMENT

A. Drum Screen General

1. Equipment provided shall be a fully automatic, internally-fed, perforated plate media, cylindrical drum screen designed to receive a pumped flow with a solids concentration as specified herein. Structural and functional parts shall be designed to prevent deflections or vibrations of rotating screen cylinder.
2. The flow shall be distributed along the internal surface of the cylindrical drum with solids larger than the perforated openings being captured on the surface of the screen and the separated liquid discharging through the perforated openings.
3. Solids shall be dewatered and conveyed to discharge by an uninterrupted, continuous dewatering/conveying flight that runs the entire length of the internal side of the cylindrical drum. Units that do not have a continuous, uninterrupted flight design shall not be accepted.
4. The cylindrical drum shall have a 5-degree angle of inclination to increase retention time for capture and dewatering. Rotating drum units without a 5-degree angle of inclination will not be accepted.

5. Each screen unit shall be provided with a rotating, cylindrical drum screen operated with a single motor drive system.

B. Drum Screen Cylinder Construction

1. The screen drum shall be of a cylindrical shape and constructed of Type 304 stainless steel perforated plate media with openings as described herein around the entire screen. The perforated media cylindrical drum shall perform the screening function of the unit.
2. The drive end of the screen drum cylinder shall be a reinforced Type 304 stainless steel end ring with a thickness of 8 mm welded to the drive end of the cylinder.
3. The screen unit shall have no running seals. Screen units with seals requiring replacement, making them susceptible to bypassing, will not be acceptable.
4. Continuous conveying/dewatering flights with a consistent height of 147 mm shall form an internal spiral along the entire length of the cylinder. The spiral flight shall advance the solids toward discharge and provide the drum cylinder with additional structural integrity.

C. Equalization Zone and Headbox Construction

1. The influent headbox shall be a variable width tapered trough designed to distribute flow evenly along both sides of the interior of the screen cylinder.
2. The influent headbox shall be fabricated of minimum 2-mm-thick Type 304 stainless steel.
3. The influent headbox trough shall be designed so that it can be completely removed at the influent end for cleaning. Screen units without removable headbox troughs will not be acceptable.
4. The influent pipe shall be provided with a Type 304 stainless steel face ring and loose back-up flange with a Class 125/150 flange bolt pattern.

D. Base Frame and Drain Pan Construction

1. The base frame and drain pan assembly shall be fabricated of Type 304 stainless steel with a minimum thickness of 3 mm. The design of the base frame will provide a stable mounting surface for the rotating screen drum, trunnion wheels, and drive assembly.
2. The base frame shall be designed to position the screen drum at an angle of 5° from horizontal toward the influent end of the unit.
3. The base frame shall incorporate four integral support legs constructed of formed Type 304 stainless steel shapes with a minimum cross-section thickness of 5 mm.

4. The base frame and drain pan of the unit shall be formed of fully welded construction to prevent leakage. The base of the screen shall be designed to capture discharged liquid from the screening process without pooling and allow free flow to the discharge point.
5. The drain pan effluent pipe shall be provided with a Type 304 stainless steel face ring and loose stainless steel back up flange having a Class 125/150 flange bolt pattern.
6. The base frame and drain pan of the unit shall incorporate an integral overflow to prevent surcharging during high flow conditions that exceed the capacity of the screen.
7. The overflow outlet shall be monitored by a capacitance rod device to detect an overflow condition and trigger an alarm.

E. Trunnion Wheel Construction and Replacement

1. The screen cylinder shall be supported by four solid nylon trunnion wheels with a diameter of 150 mm. Each wheel will be counter bored for mounting a ball bearing on each side. Ball bearings shall be sealed and lubricated for the life of the bearings. Trunnion wheels that require periodic lubrication will not be accepted.
2. The trunnion wheel shaft shall be fabricated from Type 304 stainless steel and shall have a minimum diameter of 25 mm. The trunnion wheel shaft shall have an integral retaining flange, which bolts to the trunnion wheel support.
3. Removing the retention bolt shall allow the shaft to be easily removed for trunnion wheel replacement.
4. The trunnion wheels shall be fully replaceable without removing the screen cylinder. Screen units requiring the removal of the screen cylinder for trunnion wheel replacement will not be acceptable.
5. The trunnion wheel support bracket shall be designed to fix the trunnion wheel shaft position and support the loads imposed by the drum screen cylinder.
6. A fifth nylon wheel at the influent end of the drum shall maintain the drum's lateral position. Units that use guide shoes to maintain the drum's lateral position will not be acceptable.

F. Spray Wash System

1. The screen cylinder shall be supplied with a spray bar, controlled by a brass body solenoid valve rated for the area classification as described herein.
2. The spray bar shall be constructed of 1-inch Schedule 40 Type 304 stainless steel pipe with equally spaced stainless steel spray nozzles along

the entire length of the drum to ensure complete coverage. The spray bar shall also incorporate a stainless steel splash guard to minimize misting.

3. The spray wash system requires a clean water supply as described herein. Clean water must be filtered to a minimum of 250 micron (by others).
4. In conjunction with the spray wash system, a brush on the exterior of the screen cylinder is designed to clean the screen cylinder and prevent solids from accumulating on the exterior of the screen cylinder.
5. The screen cylinder spray system shall spray from the outside the cylinder only to prevent bypass of the screenings. Any unit incorporating an internal spray bar that can force material through the screen will not be accepted.

G. Cover and Access Ports Location and Construction

1. The screen drum and discharge area shall be fully enclosed with stainless steel covers fabricated from Type 304 stainless steel with a minimum thickness of 2 mm.
2. The discharge end of the enclosure shall incorporate a screenings chute extension to direct screenings to a compactor receptacle or other solids handling equipment 12 feet below, to be field coordinated. Contractor shall coordinate optimal chute length with screenings compactor supplier
3. The screen unit shall incorporate bolted access hatches for access to the following components:

    a. Trunnion wheels.
    b. Running observation of cylinder and lateral positioning wheel inspection.
    c. Inspection of cylinder at discharge end.
    d. Inspection of the cylinder on each side and spray wash system.
    e. Drive system

4. The spray wash system access panel shall be hinged and supplied with a safety interlock switch to prevent operation while the access panel is open.

H. Drive Unit

1. The drive unit shall be rigidly supported so that no visible “wobble” movement exists under any operating condition.
2. The screen cylinder shall be driven by a single motor drive system.
3. The gear reducer shall be bolted to an adjustable base mount.
4. The gear reducer shall be driven by 240/480-volt, three-phase, 60-hz motors rated for Class I, Division 2 locations. Motor horsepower shall be determined by the screen cylinder’s diameter and length.

5. A pinion gear on the reducer shall drive a one-piece bull gear on the drum. Gears shall not be exposed to wastewater flow.
6. Pinion and bull gears shall be manufactured from low-friction, maintenance free high-density polyethylene (HDPE) material. Units using chains, belt drives, or gears manufactured of steel or stainless steel will not be accepted.
7. Motor and gear box shall be outside the screen enclosure.

I. Conveyor/Compactor General

1. The conveyor will accept solids with a dry weight not less than 8% solids at the screenings inlet. The shaftless spiral will convey the solids to the dewatering zone. Solids are then pushed through the dewatering zone to discharge and pressate liquid is directed to the drain.
2. Refer to and comply with the design performance requirements list in Article 2.01.
3. Shop Surface Preparation/Coating: All welds shall be cleaned and passivated to remove weld spatter, slag, and discoloration using the glass bead blasting process. Bearings, electrical devices, motor, and gear reducer shall be provided with the manufacturer's standard coating system.

J. Trough Assembly

1. The trough assembly shall consist of a U-trough, wear liner, inlet area, and trough cover.
2. The U-trough shall be constructed from materials as described herein.
3. The wear liner will support the spiral throughout the trough length and be constructed of 8.1-mm- (0.32-inch) thick ultra-high molecular weight polyethylene (UHMW-PE). Wear liners shall be provided in 1,219-mm (4-foot) maximum lengths and held in place by the top sections of the U-trough (no clips required).
4. Hold-down angles (when required) from Type 304 stainless steel shall be provided on both sides of the trough assembly to control excessive vertical movement of the spiral flights. Hold-downs shall not interrupt material transportation.
5. The screenings inlet area shall mate up with screen discharge chute. The inlet hopper shall have a minimum incline of 60 degrees from horizontal.
6. Except for the inlet area, the trough will be supplied with covers. Trough covers will be provided with neoprene gaskets and constructed from minimum 1-mm-thick Type 304 stainless steel and bolted to the flanges of the U-trough.

K. Shaftless Spiral Screw

1. The shaftless spiral screw shall be constructed from high-strength alloy with protective primer coating. The spiral shall have an outside diameter (OD) of 277 mm (10.9 inches) with a nominal spiral cross-section of 94 mm (3.7 inches) high x 20 mm (0.79 inches) thick.
2. Spiral flights shall have full penetration welds at all splice connections. Spiral flights shall be welded to a pipe with flanged disc end for connection to the end drive shaft.

L. Inlet Hopper

1. The inlet hopper shall be designed to accept discharge screenings from the screen discharge chute. The hopper shall directly interface with the filter screen discharge with no solids or water bypass.
2. The inlet hopper shall be fabricated from minimum 12-gauge Type 304 stainless steel.

M. Drive Assembly

1. The gear reducer shall be a helical gear type with hollow input shaft. The unit shall be provided with a cast iron frame and be designed in accordance with AGMA recommendations based on the horsepower required to operate the conveyor.
2. The motor shall be TEFC-XP (Class I, Division 1, Group D), 3.0-HP, 460-Volt, three-phase, 60 Hz. The motor shall be NEMA design code B and be direct-coupled to the reducer.
3. The dewatering zone shall consist of a dewatering cylinder, spray system, and enclosure.
4. The dewatering cylinder shall be constructed of Type 304 stainless steel with 1 mm laser-cut slotted openings. The dewatering cylinder shall extend the entire length of the dewatering zone.
5. The spray system shall rinse the basket of expressed solids and flush the solids to the drain. Connection to the spray system shall be through a 1/2-inch National Pipe Tapered (NPT) pipe. Spray flush requires washwater as described herein.
6. The dewatering zone enclosure will encapsulate the dewatering cylinder and the spray system. The enclosure will direct pressate and spray-water through a 3-inch OD plain-end pipe drain.
7. The cover over the dewatering zone shall be bolted and shall extend over the entire length of the dewatering zone.
8. Discharge back pressure shall be controlled by an iris plate from SINT® engineered polymer. The back-pressure iris plate shall control the screenings dewatering and formed plug at the discharge end.

N. Water Pump

1. A potable water booster pump shall be provided to supply 40 gpm at 70 psi water to the rotating drum screen, the shaftless conveyor compactor, and 1-1/2 inch hose bibbs one located at the drum screen/conveyor-compactor and two atop each package plant (total five hose bibbs).

2.04 ANCHORAGE AND FASTENERS

A. Anchor bolts: All anchor bolts shall be a minimum 1/2-inch-diameter and made of Type 316 stainless steel. The equipment supplier shall furnish all anchor bolts, nuts, and washers required for the equipment.

B. Fasteners: All fasteners shall be Type 316 stainless steel. The equipment supplier shall furnish all fasteners required for the assembly of the equipment.

2.05 ELECTRICAL CONTROLS AND DEVICES

A. In addition to the drive motor, the equipment supplier shall furnish all electrical items specifically called for in this Section. The Contractor shall supply all other electrical items and interconnecting wiring of proper size, including all conduit and supports required to place the equipment into service.

B. Control Panel: One 480-volt primary control panel shall be provided with a Type 316 stainless steel NEMA 4X enclosure. The panel shall be suitable for wall mounting. The panel shall include the following components:

1. Main disconnect with through-door interlock handle.
2. Control transformer.
3. Screen motor solid state soft starter with overloads.
4. Load monitor for screen motor overtorque/overload protection.
5. Emergency stop pushbutton.
6. Hand-Off-Auto (HOA) switch for screen motor.
7. HOA switch for spray-water solenoid valve.
8. Hour meter for each motor.
9. Run indicating lights.
10. Alarm lights indicating overcurrent and starter overload.
11. Alarm reset pushbutton.
12. Programmable control relay for screen and compactor control logic functions.
13. Run and alarm auxiliary contacts.

14. Barrier relay for high level probes.
15. Underwriters Laboratories Inc. (UL) Label for 14k SCCR rating.

C. The following control components will be added to the screen control panel to provide proper operation of the conveyor/compaction unit:

1. Branch circuit protection.
2. Motor starter, reversing with overloads.
3. HOA switch for motor.
4. Forward-Off-Reverse switch, spring return from Reverse to Off.
5. Hour meter for each motor.
6. Run indicating light.
7. Alarm lights indicating overcurrent and starter overload.
8. Run and alarm auxiliary contacts.

D. Emergency Stop pushbutton station that shall be rated for NEMA 4X.

E. Safety Microswitch: 120-volt safety interlock switch shall be factory mounted to the spray wash access door. The interlock switch shall prevent operation of the screen while the door is open. The switch housing shall be rated for NEMA 4X and shall be protected by an intrinsic safety barrier relay.

F. Solenoid Valves: Provide solenoid valves to control flow to the spray-wash assembly. The valve shall have a brass body and shall be 120-volt, single-phase, 60 Hz. Each valve shall be rated for the NEMA 4X.

G. Provide float switches to monitor the upstream liquid level. The level switches shall be direct acting and mercury-free. The float shall be watertight, of polyethylene construction, and foam-filled. The switch shall be single-pole double-throw (SPDT), operating whenever the float is tilted 1-1/2 inches beyond horizontal. The switch shall be 5-amp 120/240 VAC rated. The integral cord shall be three-conductor, 18-gauge, with a Chlorinated Polyethylene (CPE) jacket as a minimum. The length shall be suitable for the application. SJE SignalMaster® or equal.

H. Provide and install Intrinsic Safety Relays (ISR) for use with the level switches. The ISRs shall comply with the requirements of UL 913 and IEC 60079.

I. All internal wiring shall be 600-volt rated, strained copper and identified on each end.

J. The control panel shall provide for remote monitoring of all equipment status and alarms. The signals shall be dry contacts wired to a terminal block identified as remote alarms and status.

2.06 OPERATION, MONITORING, AND CONTROL

A. Hand Operation: The screen, spray-wash, and conveyor/compactor spiral shall run continuously. Turning the selector switch to OFF will stop the units.

B. Automatic Operation: The screen runs when the screen-control panel receives a call to run from the influent pumps. The spiral will cycle on and off on demand from a remote contact closure from the screen-control panel system. An off delay timer shall control the end of the conveyor/compactor operational sequence. The spray-wash system shall operate via an on/off repeat timer whenever the screen drum is rotating.

C. Emergency Stop: The unit can be deactivated at any time by pressing the control-panel-mounted or local emergency-stop push-buttons.

D. Fault Conditions: The motor-overload condition shall stop the motor and illuminate the fault light. Fault conditions include:

1. A momentary motor over-current shall trip the current monitor, stop the drive motor, and illuminate the alarm indicating light. Reset shall be manual on the outside of the control panel.
2. An excessive motor current shall trip the starter overload relays, stop the drive motor, and illuminate the alarm indicating light. Overload relays shall be reset manually on the inside of the control panel.

E. Alarm Conditions: Detection of flow through the overflow outlet will trigger an overflow alarm to alert the operator of the overflow condition. The screen will continue to run normally during overflow conditions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the equipment at the locations generally shown on the Drawings and in accordance with manufacturer's instructions and recommendations and the approved shop drawings. Before construction, the Contractor shall verify the dimensions and corresponding final locations in the field to ensure compliance of equipment dimensions in the Drawings for the screens, screen pivot supports, supporting concrete surfaces, and the screening chute/pipe.

B. Installation shall include furnishing the required lubricants for initial operation in accordance with the manufacturer's specifications and recommendations.

C. The mounting points of the operating platform shall be level and parallel and of proper size.

D. Lifting points shall be identified on all equipment. A crane of sufficient capacity must be on site for unloading the equipment from the truck and placing on the operating platform for installation.

3.02 FIELD TESTING

A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup and startup/ performance testing and final mechanical performance testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. If additional service is required due to the equipment not being fully operational at the time of service requested by the Contractor, the additional service days will be at the Contractor's expense.

1. Pre-Startup Testing performed by manufacturer representatives:

   a. Visually inspect the screens and certify that the drive assemblies have been furnished in accordance with the specifications herein regarding horsepower, maximum input torque (100% rated load), voltage, phase, and hertz.
   b. Visually inspect and verify that the incoming electrical service and controls to the screen and washing press have been installed in accordance with the manufacturer’s recommendations.
   c. Verify that the screen control panel has been furnished with all controls and alarms specified herein and that the alarms have been installed in accordance with the manufacturer’s recommendations.
   d. Verify that the settings of each current sensing device are correct and adjust them in accordance with the manufacturer’s recommendations as needed.
   e. Verify that the screens have been installed in accordance with the Contract Documents and manufacturer’s recommendations.

2. Startup Testing: The factory-authorized service representative shall perform the startup testing specified herein:

   a. Verify that the corresponding alarms and safety shutdowns have been installed and are operating in accordance with the Contract Documents and manufacturer’s recommendations. These features shall be checked by artificially simulating an alarm and/or safety shutdown or control condition as required.

b. Verify that the screens are operating in accordance with the performance requirements specified in the Contract Documents and in accordance with manufacturer's recommendations. Adjust the equipment components as needed for compliance with the manufacturer's recommendations.

3.03 TRAINING SERVICES

A. The factory-authorized service representative shall be on site to perform training services. Site services of one trip total for a total of 2 days shall be coordinated for installation inspection, startup, and operator training.

3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified herein.

END OF SECTION

SECTION 11355
END-SUCTION NON-CLOG CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes provisions for the complete installation of end-suction non-clog centrifugal pumps and appurtenances. All pumps specified in this Section shall be from a single manufacturer. End-suction non-clog centrifugal pumps, motors, appurtenances, as shown in the Drawings and specified in this Section shall be furnished for the following:

1. The Internal Recycle (IR) Pumping Stations.
2. The Equalization Basin (EQ) Pumping Stations.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Shop Drawings: The Contractor shall submit integrated shop drawings for the pumping system illustrating the mechanical and electrical equipment and components specified in this Section and include the following:

1. Product Data: For each mechanical and electrical component include the manufacturer's descriptive literature, product specifications, published details, technical bulletins, performance, and capacity-rating curves with primary and secondary design conditions clearly noted, charts, and schedules, catalog data sheets, and other submittal materials as required to verify that the proposed products conform to the quality and function of the specified products.

a. Identification: Clearly indicate by an arrow on submissions covering more than one product type or style exactly which product is being submitted for approval.
b. Equipment Characteristics: Provide gear and bearing ratings, complete motor data, service factors, shaft diameters, coupling type, and weights of principal parts and assembled equipment.
c. Manufacturer: Include the catalog name, company name, address, and telephone number for each product submitted.

2. Equipment Drawings: Submit completely dimensioned plan, elevations, and cross-sections of system equipment and sub-assemblies.

3. Layout Drawing: Submit completely dimensioned drawing of a base-mounted pump assembly that includes foundation details, anchor bolt size and patterns, supports, installation notes, and other pertinent setting details.

4. Product List: Provide a list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.

5. Additional Requirements: See Division 13, Special Construction, for additional submittal requirements for the control panels furnished under this Section and specified below.

B. Pump Test Report: Submit certified copies of factory-run pump performance test curves. Factory certified performance test curves shall indicate the following:

1. Flow in gallons per minute (gpm)

2. Pressure in feet of water

3. Horsepower

4. Pump efficiency in percent of input shaft horsepower

5. Pump data

    a. Model number
    b. Serial number
    c. Impeller diameter and type
    d. Impeller speed

6. Test condition data

    a. Date of test
    b. Mean water temperature

C. Installation Certificate: Submit certification of installation as specified below.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

B. American Society for Testing and Materials (ASTM)

1. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
2. ASTM A536—Standard Specification for Ductile Iron Castings.

C. Hydraulic Institute (HI)

1. HI-01—Standards for Centrifugal, Rotary and Reciprocating Pumps.

D. International Standards Organization (ISO)

1. ISO 5199—Technical Specifications for Centrifugal Pumps, Class II.
2. ISO 7005-2—Metallic Flanges Part 2: Cast Iron Flanges.

E. National Electrical Manufacturer's Association (NEMA)

1. NEMA 4—Electrical Enclosures.
2. NEMA 4X—Electrical Enclosures.
3. NEMA 12—Enclosures Construction (without Knockouts) for Indoor Use.
4. NEMA 250 Enclosures for Electric Equipment (1,000 Volts Maximum).
5. NEMA ICS-1—Industrial Control and Systems – General Requirements.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for 2 years. The warranty period shall begin at the date of substantial completion.

C. The warranty shall cover replacement equipment materials, parts, and/or repair, including labor, travel time, shipping costs, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period.

1.05 OPERATIONS AND MAINTENANCE (O&M) MANUALS

O&M manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals, and shall include the following:

A. Installation instructions.

B. Functional description of the pumping control system for each mode of operation of equipment.

C. Automatic and manual operation.

D. Alarms and fail-safe features.

E. Interlocked and/or interfaced equipment operation and control.

F. Exploded view drawings and illustrations with descriptions for assembly and disassembly of equipment.

G. Comprehensive parts and materials maintenance and repair list for each equipment element indicating the manufacturer and the manufacturer's identification number. Include name, address, and telephone number of local sales and service office for major equipment items.

H. Schedules of recommended spare parts to be stocked, including part number, inventory quantity, and ordering information.

I. Performance rating and nameplate data for each major system component.

J. Procedures for starting, operating, adjusting, calibrating, testing, and shutting down system equipment.

K. Emergency operating instructions and trouble-shooting guide.

L. Schedule of routine maintenance requirements and procedures and preventative maintenance instructions required to ensure satisfactory performance and equipment longevity.

M. Maintenance instructions for extended out-of-service periods.

N. Schedule of lubrication requirements including lubricant type, service interval, and lubrication points.

O. Field verified power and control wiring schematics. Submit the approved schematics in each manual. After initial start-up and operation, correct these schematics to reflect any required field changes and submit the required copies for inclusion in the manuals.

P. Four preliminary copies of the O&M manuals shall be submitted to the Owner before arrival of the equipment to the site. The Contractor shall not be compensated for the pumping equipment until the Owner receives the preliminary O&M manuals. Four copies of the final O&M Manuals shall incorporate the Engineer's comments and be submitted with copies of the approved shop drawings and test reports.

Q. Installation Certificate: Submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each pump furnished and installed and specified in this Section, stating that the installed equipment has been installed, inspected, and adjusted as required in accordance with the manufacturer's written installation procedures and operating instructions and is ready for acceptance by the Owner.

PART 2 PRODUCTS

Materials and equipment shall conform to the referenced publications or as specified and indicated and shall be the products of manufacturers regularly engaged in the manufacture of such products.

2.01 END-SUCTION NON-CLOG CENTRIFUGAL SEWAGE PUMPS

A. The end-suction non-clog centrifugal pumps shall be solids handling horizontal and vertical frame-mounted pumps suitable for pumping raw, unscreened sewage and shall be designed and fully warranted for this service.

B. Pump Construction: The pump casing, volute, and back plate shall be a heavy-duty casting made of gray cast iron, ASTM A48/A48M, Class 30. All mating parts shall be machined with registered fit to ensure proper alignment. The pumps shall be the solids handling series, back-pull out design. Suction and discharge connections shall be ANSI 125-pound flanged connections. Pump casing, volute, and backplate shall be able to withstand in excess of 150% of the pump shutoff head pressure. The back plate shall have deflector vanes designed to help the impeller back vanes reduce solids and air buildup and entrapment behind the impeller and around the shaft inner seal faces.

C. Impeller: The impeller shall be constructed of cast iron, ASTM A48/A48M, and shall be of the two-vane, semi-open non-clogging design. The impeller shall have back pump-out vanes to reduce axial thrust and seal area pressure and to prevent grit and other materials from collecting in the seal area. The impeller shall have a

straight non-tapered shaft bore and be dynamically balanced. The impeller shall be keyed to the shaft and secured with a stainless steel washer and impeller lock screw.

D. Stuffing Box/Mechanical Seal: The stuffing box shall be integral to the backplate and constructed of ASTM A48/A48M Class 30 cast iron. The mechanical seal shall be suitable for abrasive service and require no external water flush. The seal faces shall be constructed of Tungsten carbide and silicon carbide materials. Seals shall be Cornell CycloSeal or Chesterton with Spiral Trac.

E. Shaft: The shaft shall be heavy-duty stress-proof steel (SAE 1144) with stainless steel AISI 416 shaft sleeve, accurately machined and polished and of sufficient size to transmit full driver output. The shaft sleeve shall extend through the stuffing box. The sleeve shall be grooved on the inside for an O-ring to prevent leakage along the shaft and shall be positively locked to prevent rotation on the shaft. The steps in the shaft shall be properly radiused to reduce stress concentrations. The shaft deflection shall be minimized to promote longer seal and bearing life. Shaft deflection information shall be supplied, documented, and certified by the pump manufacturer and submitted with pump submittal data.

F. Bearing Frame and Bearings: The bearing frame shall be of one-piece ASTM A48/A48M Class 30 cast-iron end covers at both ends of bearing frame. Bearing frames shall be designed so that complete rotating element can be removed from the casing without disturbing the piping. Bearings shall be of the roller or ball type and of sufficient size to withstand the radial and axial thrust loads incurred during service. The pump end and drive end bearings shall have in excess of 100,000 hours B-10 bearing life. The B-10 bearing life shall be calculated, documented, and certified by the manufacturer and submitted with pump submittal data.

G. Bearing Lubrication: The bearings shall be grease lubricated with Lube Site Systems, Inc. Series 305 automatic lubricators, provided to facilitate lubrication.

H. Suction Elbows for Vertically Mounted Pumps: Suction elbows shall be of one-piece ASTM A48/A48M Class 30 cast-iron, heavy section construction with a bolted and contoured clean-out port and plug. The base shall be of sufficient strength to support the entire weight of the assembled pump and of sufficient height so that no part of the elbow will touch the floor.

I. Pump and Motor Base and Guard for Horizontally Mounted Pumps: Horizontally mounted pumps shall be supplied with ASTM A48/A48M Class 30 or fabricated steel pump and motor support base. The base shall be machined for accurate location, alignment, and support of the pump and motor. The base shall include anchor bolt holes, grout holes, and a vent hole at each end of the base for venting entrapped air from the base during pouring of the grout in mounting the base to its

cast-in-place concrete support pads. The base shall include an OSHA-compliant shaft and coupling guard. A rubber spacer in shear-type flexible coupling shall be furnished.

J. Motors: The motors shall be three-phase, 460-volt, inverter duty rated, total enclosed and fan-cooled, non-overloading, squirrel cage induction-type motors suitable for use and operation exposed and outdoors and shall conform to the requirements of Section 16150, Motors.

1. The motors shall have a 1.15 service factor and the pumps, operating at either the present or future design condition, shall not use this service factor or operate at above the pump motor name plate rating during any present or future pumping condition. Motors to include space heaters at 120 VAC and motor thermostats.

2.02 PUMP PERFORMANCE AND DESIGN CRITERIA

A. Equalization Basin Pumping Stations

1. Pumped Liquid Characteristics:

a.	Liquid	Raw wastewater.
b.	Temperature Range	18 to 30ºC.
c.	pH range	6 to 8.5.
d.	Solids Content	5,000 to 15,000 mg/l total suspended solids, some abrasive grit and fine sand, plastics, and stringy material.

2. Pump Characteristics:

a.	Number of pumps:	Three.
b.	Design Condition (each)	175 gpm @ 16 feet TDH.
c.	Shut-Off Head	20 feet.
d.	Solids Handling Size	3 inches.
e.	Configuration	Horizontal Frame Mounted.
f.	Suction Size	4 inches.
g.	Discharge Size	4 inches.
h.	Motor Speed	900 rpm.
i.	Motor Horsepower	3 HP.
j.	Electrical Service:	460V, 60 Hz, three-phase.

3. Acceptable Manufacturers:

a. Cornell Pump Company, Model 4NNDH.
b. Approved equal.

B. Internal Recycle Pump Station

1. Pumped Liquid Characteristics:

a.	Liquid	Aerated, activated sludge, solids, Settled activated sludge, solids, slurry.
b.	Temperature Range	65 to 86º F.
c.	pH range	6 to 8.5.
d.	Solids Content	5,000 to 15,000 mg/l total suspended solids, some abrasive grit and fine sand, plastics, rags, and stringy materials.

2. Pump Characteristics:

a.	Number of pumps:	Two.
b.	Design Condition (each)	700 gpm @ 13 feet TDH.
c.	Shut-Off Head	27 feet.
d.	Solids Handling Size	3 inches.
e.	Configuration	Horizontal Frame Mounted.
f.	Suction Size	6 inches.
g.	Discharge Size	6 inches.
h.	Motor Speed	900 rpm.
i.	Motor Horsepower	5 HP.
j.	Electrical Service:	460V, 60 Hz, three-phase.

3. Acceptable Manufacturers:

a. Cornell Pump Company, Model 6NHDH.
b. Approved equal.

2.03 MOTORS AND DRIVES

A. Motors: The motors shall meet the requirements of Section 16150, Motors.

2.04 MISCELLANEOUS

A. All miscellaneous metal fabrications, hangers, fasteners, and hardware, etc. shall be AISI Type 316 stainless steel.

2.05 ANCHOR BOLTS

A. Pump base anchor bolts shall be AISI Type 316 stainless steel anchors designed for embedment in cast-in-place concrete. The pump manufacturer shall recommend anchor bolt size and embedment depth and furnish all anchor bolts and positioning templates.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. Each pumping station system shall be installed as indicated, in accordance with these Specifications, Drawings, and the manufacturer's written instructions.

C. Install the equipment in the locations as shown on the Drawings and in accordance with the manufacturer’s instructions and recommendations and the approved shop 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.

D. Grout the surfaces under the chopper pumps and discharge elbows as required for level mounting on concrete equipment pads. All anchor bolts shall be AISI Type 316 stainless steel and shall be furnished by the pump manufacturer.

E. Adjust pump assemblies so that the motors are properly aligned, plumb, and level with the pumps and all interconnecting shafts and couplings. Flexible couplings shall not be approved as a way to compensate for misalignment.

F. All strain from the attached piping shall be eliminated from the pumps, and any evidence of pump or motor misalignment, noisy operation, or other signs of improper setting shall be corrected using the means specified in this Section by the Contractor at no additional cost to the Owner. Care during storage, installation, and lubrication shall be in strict accordance with the manufacturer’s recommendations.

3.02 PAINTING

A. The Contractor shall paint all of the equipment specified in this Section in accordance with Section 09900, Painting and Coating.

3.03 FIELD TESTING

A. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory-authorized service representative shall be onsite to perform the field testing services specified in Table 11000-1 of Section 11000, General Equipment Requirements.

2. The following field testing services shall be performed by the factory-authorized service representative for each pump:

    a. Verify equipment has not been damaged by transportation or installation.
    b. Verify equipment has been properly installed.
    c. Verify equipment has no mechanical defects.
    d. Verify equipment is in proper alignment.
    e. Verify equipment has been properly connected.
    f. Verify equipment is free of overheating of any parts.
    g. Verify equipment is free of all objectionable vibration.
    h. Verify equipment is free of overloading of any parts.

3. The pump shaft alignment to the motor shaft shall be confirmed by laser before start-up of the pumps.

4. The Contractor shall promptly correct any defects in the equipment installation or operating controls and replace all defective items.

5. Pre-Startup Testing

    a. Visually inspect each pump and certify that the pump and motor have been furnished in accordance with the Specifications in this Section as to horsepower, maximum input torque (100% rated load), voltage, phase, and hertz.

b. Visually inspect and verify that the incoming electrical service and controls to the control panel and each pump have been installed in accordance with the manufacturer's recommendations.

c. Verify that the control panel has been furnished with all of the controls and alarms specified in this Section and have been installed in accordance with the manufacturer's recommendations.

d. Verify that the pump discharge pressure gauges have been installed at locations that give accurate and representative pressure readings at the pump inlet and discharge. The Contractor shall remove, plug the gauge connections, relocate, and reinstall any pressure gauge that has not been installed at a location that does not give an accurate pressure reading at no additional cost to the Owner.

e. Verify that the oil-level monitoring system has been installed in accordance with manufacturer's recommendations.

f. Artificially enable and disable control and alarm signals previously described in this Specification to simulate a real-time occurrence:

g. Verify all indicating lamps on the Control Panel are annunciated as specified in this Section.

h. Verify the pump discharge elbow has been installed in accordance with the pump manufacturer's recommendations.

i. The pump shall be run dry to establish correct rotation and mechanical integrity.

6. Startup Testing: The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.

a. Verify that the corresponding alarms and safety shutdowns have been installed and are operating in accordance with the Contract Documents and the manufacturer's recommendations. These features shall be checked by artificially simulating an alarm and/or safety shutdown or control condition as required.

b. Fill the secondary clarifier and aerobic digester tanks with water as needed to perform the following tests with liquid:

(1) Fill to the PUMP ON water surface elevation with "clean water" shown on the Drawings, demonstrate operation of each pump at the primary guarantee point specified in this Section, at which time data shall be recorded on the total head, capacity, and horsepower requirements of each pump.

(2) Verify that the pump automatically enables upon the receipt of a start signal generated by the programmable control

timer controller in the Control Panel and the time between operating cycles resets after a pump cycle has begun.

(3) Verify operation of pump station TROUBLE alarm combining all alarm conditions in the station.

7. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of this equipment in accordance with Section 11000, General Equipment Requirements.

3.04 SPARE PARTS

A. The Contractor shall furnish the following spare parts for each pump in clearly identified containers, labeled for easy identification without opening the packaging, and suitably protected for long-term storage in a humid environment:

1. Two complete mechanical seals for each type/size of pump.
2. Two volute gaskets for each type/size of pump.
3. One spare drive belt per belt-driven pump.

3.05 TRAINING SERVICES

A. An authorized representative of the pump manufacturer shall inspect the pump installation; assist with the startup of each pumping station; and instruct representatives of the Owner in startup, operation, and maintenance procedures. The Contractor shall procure the services of the pump manufacturer's representative on the project site in accordance with the requirements of Table 11000-1 of Section 11000, General Equipment Requirements. Before startup the manufacturer's representative shall be onsite to individually inspect, adjust, and test the pumping stations and provide certifications as specified. Subsequent to successful pre-startup functional testing for each pumping station, the manufacturer's representative shall be onsite to help the Contractor place each station in operation and demonstrate compliance with the requirements of the Contract Documents and to train representatives of the Owner in the operation, maintenance, and repair of station pumps, control panels, and related appurtenances.

B. The manufacturer's services specified represent an absolute minimum acceptable level of service and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents for inspection, testing, certification, start-up, trouble-shooting, and training. The Contractor shall procure, at no additional cost to the Owner, all services required, including additional or extended trips to the job site by the manufacturer's representative, to comply with these requirements.

3.06 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. The Contractor shall submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each pump furnished and installed and specified in this Section stating that the installed equipment has been installed, inspected, and adjusted as required in accordance with the manufacturer's written installation procedures and operating instructions and is ready for acceptance by the Owner.

B. The pump shall be inspected to confirm that it is installed in accordance with the manufacturer's recommendations and requirements.

END OF SECTION

SECTION 11356
PROGRESSING CAVITY PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to provide the self-priming, positive displacement progressing cavity pumping units and appurtenances specified in this Section and shown on the Drawings. Each pumping unit shall be specifically designed to transfer either digested activated sludge from aerobic digester(s) or leachate to or from leachate holding tank(s). All equipment shall be installed, adjusted, tested, and placed in operation in strict accordance with this Section and the manufacturer's recommendations.

B. Each pumping unit shall be designed and constructed to operate satisfactorily with minimum noise, vibration, and cavitation, and reasonable long service life when operated continuously or intermittently for waste activated sludge.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.

B. Descriptive literature, bulletins, and/or catalogs of the equipment.

C. Complete master wiring diagrams and elementary or control schematics drawings, including coordination with other electrical control devices such as the pump control system, shall be furnished for approval before proceeding with manufacturing. Drawings should show such details that are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable. Refer to the Electrical and Instrumentation Drawings for the control wiring diagrams for the pump motors.

D. A complete bill of materials of all equipment.

E. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in this Section, with the manufacturer's current price for each

recommended space part item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's name and corresponding numbers.

F. Complete motor data.

G. Test reports to be submitted: Tests shall be conducted at a minimum of five points along the pump performance curve on the actual pumping units to be furnished. All equipment tested by the pump manufacturer shall certify to its compliance with the project requirements. Curves and other information shall be submitted on 8-1/2-inch-by-11-inch sheets at as large a scale as is practical. Curves shall be plotted from zero flow at shut-off head to pump capacity at minimum specified head:

1. Certified factory test results of each pumping unit in accordance with the standards of the Hydraulic Institute.
2. Factory-tested, certified, and guaranteed pump performance curves showing the specified requirements for head/capacity, brake horsepower, pump efficiency, speed of rotation, and NPSHR for each pumping unit. Characteristics of pumps furnished may have a tolerance of 1% percent below or 5% above the head and capacity of the specified requirements.

H. The Contractor shall submit the Manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1, General Requirements.

I. If it is not possible to comply with certain requirements of this Specification, include in submittals a complete description of all requirements not complied with.

J. The Contractor shall submit a signed letter from an authorized representative of the pump manufacturer certifying that each pumping unit will not clog or bind on the solids typically found in the application specified in this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

B. American Society for Testing and Materials (ASTM)

C. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.

D. American Gear Manufacturers' Association (AGMA)

E. American Welding Society (AWS)

F. Anti-Friction Bearing Manufacturers Association (AFBMA)

G. National Electrical Manufacturer’s Association (NEMA)

1. NEMA MG 1—Motors and Generators Standards.
2. NEMA MG 1-12.58.1—Standardized Method for Testing.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. The pumps shall be shipped to the jobsite complete with the motor, local wiring, control, equipment base, and anchor bolts and other appurtenances as specified pre-installed. Spare parts shall be shipped loose and ready for installation at the location shown on the Drawings.

C. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the mechanical, electrical, and material integrity established by these Specifications will not be acceptable as determined by the Engineer.

D. All of the equipment, accessories, and controls specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

1.05 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements. Additionally, the pump manufacturer shall meet the following qualifications that

supersede the requirements specified in Section 11000, General Equipment Requirements:

1. The manufacturer shall have a minimum of 10 installations in Florida that are similar to the pumping equipment specified in this Section. The Engineer shall reserve the right to determine if previous installations by the manufacturer are similar to the pumping equipment specified in this Section.
2. The Contractor shall submit a list of no fewer than 15 reference installations of pumps in identical service applications to those specified in this Section. At least five of the reference installations provided shall be of the exact model pump specified in this Section. References shall be pumps that have been in continuous service for at least 3 years from the Bid Date.

1.06 MAINTENANCE

A. The Contractor shall furnish the following spare parts for each pump in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.

1. One stator assembly with TSE sensor sleeves
2. One of each set of mechanical seals
3. One rotor

1.07 SYSTEM DESCRIPTION

A. Sludge Truck Loading Pumps

1. The pumping equipment specified in this Section shall be designed to pump digested sludge from Digesters to Truck Loading as shown on the Drawings.

B. Leachate Truck Offloading Pumps

1. The pumping equipment specified in this Section shall be designed to pump leachate from Leachate Trucks to Leachate Holding Tanks as shown on the Drawings.

C. Leachate Discharge Pumps

1. The pumping equipment specified in this Section shall be designed to pump leachate from Leachate Holding tanks to Manholes as shown on the Drawings.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. Sludge Truck Loading Pump No. 1.
2. Sludge Truck Loading Pump No. 2.
3. Leachate Truck Offloading Pump No. 1.
4. Leachate Truck Offloading Pump No. 2.
5. Leachate Discharge Pump No. 1.
6. Leachate Discharge Pump No. 2.

B. Service Conditions

1. Liquid Pumped: Digested Sludge:

   a. Percent Solid: 1.0 to 2.0 %.
   b. Design Specific Gravity: 1.05.
   c. Apparent Viscosity: 800 cPs.
   d. Solid Size: 1 to 3 inch.
   e. pH: 5 to 9.
   f. Design Pumping Temperature: 68º to 95º F.

2. Liquid Pumped: Leachate:

   a. Percent Solid: Less than or equal to 1.0 %.
   b. Design Specific Gravity: 1.0.
   c. Apparent Viscosity: < 500 cPs.
   d. Solid Size: 1/2 inch.
   e. pH: 5 to 9.
   f. Design Pumping Temperature: 68º to 95º F.

C. General Design Requirements

1. Sludge Truck Loading Pumps:

   a. Number of Sludge Pumps: Two.

   b. Primary Rated Capacity (Each Pump): 600 gpm at 15.0 psi.

   c. Suction Diameter: 8 inches ASME B16.5 RF Flanges Class 150.

d. Discharge Diameter: 6 inches ASME B16.5 RF Flanges Class 150.

e. Acceptable Manufacturers:

(1) Seepex Model BNM 130-6L.
(2) Engineer-approved equal.

2. Leachate Truck Offloading Pumps:

a. Number of Sludge Pumps: Two.

b. Primary Rated Capacity (Each Pump): 600 gpm at 15.0 psi.

c. Suction Diameter: 8 inches ASME B16.5 RF Flanges Class 150.

d. Discharge Diameter: 6 inches ASME B16.5 RF Flanges Class 150.

e. Acceptable Manufacturers:

(1) Seepex Model BNM 130-6L.
(2) Engineer-approved equal.

3. Leachate Discharge Pumps:

a. Number of Sludge Pumps: Two.

b. Primary Rated Capacity (Each Pump): 5 gpm at 15 psi.

c. Secondary Rated Capacity (Each Pump): 20 gpm at 15 psi.

d. Suction Diameter: 2.5 inches ASME B16.5 RF Flanges Class 150.

e. Discharge Diameter: 2 inches ASME B16.5 RF Flanges Class 150.

f. Acceptable Manufacturers:

(1) Seepex Model BN 5-6L
(2) Engineer-approved equal

D. Pump Mounting

1. Base Mount (on a common fabricated-steel base-plate).

2.02 EQUIPMENT

A. The pumping equipment specified in this Section shall in general consist of the following components:

1. Pump Case.

2. Rotor.

3. Stator.

4. Drive Train:

   a. Universal Joint.
   b. Drive Shafts.
   c. Bearings.

5. Motor.

B. Pump Casing

1. The pump body shall be thick-walled cast iron. The suction housing shall include two rectangular inspection ports 180º apart and shall provide access to the universal joint(s) within the suction housing. All cast parts will be smooth and free of sandholes, blowholes, and other defects.

C. Rotor and Stator

1. Each pump shall employ a single-helix convoluted rotor operating in a double-helix convoluted stator.

2. The convolutions shall be configured to form a cavity between the rotor and stator progressing from the pump inlet to pump discharge outlet with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form sufficient sealing to prevent leakage of sludge.

3. The rotor shall be constructed from hardened D6 tool steel with a minimum Rockwell hardness of 60-62 hRc.

4. The rotor shall be provided with the following coating or plating systems:

   a. Chromium Nitride Coating (Duktil) with a minimum thickness of 0.0108-inch with a minimum hardness of 1250 Vicker or Tungsten

Carbide Coating with a minimum thickness of 0.0108-inch with a minimum hardness of 1250 Vicker.

5. The stator shall be chemically bonded to a steel tube. The stator material shall be a single piece medium-high acrylonitrile Buna-N rubber with a minimum Durometer hardness (Shore A) of 70-76. Modular casing and stator is acceptable to allow the stator and roto to be disassembled without need to remove outlet piping.

6. The stator shall use 720º clamp rings to fasten to the normal horizontal flange and suction housing and shall have sealed ends. The stator seals shall be designed to prevent the material from being pumped from contacting the stator bonding and tube.

D. The rotor/stator shall include a temperature alarm panel for each pump. The panel shall be 120 volts incoming power, all NEMA 4X, 316 stainless steel, UL rated for 5k SCCR as an assembly. Alarm contacts for remote monitoring.

E. Drive Train

1. Each pump rotor shall be driven with a positively sealed and lubricated, shielded, and crowned universal joint. The joint shall have L5 and D6 tool steel replaceable bushings in the rotor head, connecting rod, and drive shaft quill. The tool steel components shall be 57-60 hRc. The thru-bolt shall be constructed of high-speed steel, air hardened to Rockwell 60-65 hRc. Each universal joint shall be filled with 335 cm3 PTFE synthetic grease minimum rated to 450°F. Universal joint sleeves shall be Buna-N or equal and positively sealed by 316 SS clamps. Universal joint shall withstand 100-psig suction pressure without ingress of liquid into the seal component. In addition, a 316 SS shell shall encompass the elastomer sleeve. The operating angle of universal joint shall not exceed 1.5°.
2. A splinted connecting rod shall connect the gear joints of the eccentrically moving rotor and the drive shaft. The connecting rod shall be connected to a solid drive shaft or shall pass through the suction housing/shaft seal area within the hollow drive shaft quill.
3. The drive shaft shall be of two-part design with the chrome-plated hollow quill. The quill shall be removable without removing the bearing from the bearing housing or disconnecting the driver. The shaft shall be sealed using a single internal mechanical seal not requiring a water flush system.
4. Each pump shall be provided with an oil- or grease-lubricated ball or tapered roller-type bearings designed for all thrusts and loads imposed by the specified service. Fittings shall be provided in the bearing housing for occasional lubrication. A minimum B-10 life of 100,000 hours shall be provided under the maximum operating conditions. The bearing casting

shall use a bolted bearing cover plate held in place by a 720º retaining ring.

F. Motor

1. The motors shall meet the following:

a.	Motor Duty	Inverter Duty
b.	Horsepower	
	Truck Loading Pump	40
	Leachate Truck Pump	40
	Leachate Discharge Pump	2
c.	Voltage	230/460
d.	Phase	Three
e.	Hertz	60
f.	Nominal Motor Speed	1800 rpm
g.	Motor enclosure	IP55 or TEFC
h.	NEMA Design Letter	B
i.	Insulation Class	F
j.	Service Factor	1.15
k.	Bearing Life	100,000 hour (AFBMA B_{10})

2. All motors shall have NEMA Premium Efficiency in accordance with NEMA MG 1-12.58.1 and guaranteed minimum full load efficiency labeled on the motor shall be equal or exceed the values in NEMA MG 1 Table 12-12.

3. Each motor shall be provided with two motor winding thermostats and space heaters. Thermostats shall be connected in series and embedded in adjoining phases as required by Underwriters Laboratories for motors of 1 HP or larger. Thermostats shall be automatic reset, normally closed contact rated at 3 amperes at 115 VAC.

4. A vertical upright gearmotor shall drive the pump with a NEMA C face connection between the motor and the gearbox. The gearbox shall employ helical reduction gearing with a service factor of 2.0 and AGMA Service Classification II. Gears shall run in an oil bath and the reducer housing shall be equipped with oil fill, drain and level indication. Gears shall be full filet, radius forged, and carburized. Gearbox housing shall be single-piece iron casting with internal reinforcement.

5. Each pump motor shall be designed to withstand up to 15 separate pump starts per hour.

6. Acceptable manufacturer:

a. Baldor.
b. US Motors.
c. Marathon Electric.
d. Engineer Approved Equal.

2.03 PAINTING

A. Equipment shall be provided with the manufacturer's recommended shop and field coating systems for severe-duty services.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. Install the equipment in the locations as shown on the Drawings and in accordance with the manufacturer's published instructions and recommendations and the approved shop 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.

C. All anchor bolts and fasteners shall be AISI Type 316 stainless steel and shall be furnished by the pump manufacturer.

D. Adjust pump assemblies so that the motors are properly aligned, plumb, and level with the pumps and all interconnecting shafts and couplings.

E. Provide non-shrink grout for pump installation in accordance with Section 03610, Grouting—Non-Shrink Epoxy Machinery Grout.

F. All strain from the attached piping shall be eliminated from the pumps, and any evidence of pump or motor misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor using the means specified in this Section at no additional cost to the Owner. Care during storage, installation, and lubrication shall be in strict accordance with the manufacturer's recommendations.

3.02 FIELD TESTING

A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory-authorized service representative shall be onsite to perform the field testing services in accordance with Table 11000-1, Equipment Testing and Training Requirements, in Section 11000, General Equipment Requirements.
2. Pre-Startup Testing: The factory-authorized service representative shall perform the pre-startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements
3. Startup Testing: The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.
4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.
5. Noise and vibration tests shall be conducted in conformance with the Hydraulics Institute Test Codes and OSHA Standards of Occupational Noise Exposure. Maximum allowable noise level, corrected for background sound, shall not exceed 85 dBA when measured at a horizontal distance of 3 meters from the equipment being tested, at a height of 3 meters above floor level. The actual natural frequency of the installed pumping units will be verified using industry accepted procedures.
6. All pumps operating settings, alarms, controls, and shutdown devices shall be calibrated and tested ruing the field tests.
7. The Contractor shall furnish all power, water, facilities, labor, materials, supplies and test instruments required to conduct field test.

3.03 TRAINING SERVICES

A. An authorized representative of the pump manufacturer shall instruct representatives of the Owner in startup, operation, and maintenance procedures. The Contractor shall procure the services of the pump manufacturer’s representative on the project site for training service, exclusive of travel time, in accordance with Table 11000-1 of Section 11000, General Equipment Requirements. The manufacturer's services specified represent an absolute minimum acceptable level of service and are not intended to limit the

responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall procure, at no additional cost to the Owner, all services required to comply with these requirements, including additional or extended trips to the job site by the manufacturer's representative.

3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 11378
POSITIVE DISPLACEMENT BLOWERS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to provide positive displacement (PD) blower equipment specified in this Section and shown on the Drawings. The blowers shall be rotary, positive displacement, belt-driven, and shall be complete with all appurtenances necessary to make the equipment complete and operable in compliance with the following Specifications.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings including the manufacturer's descriptive literature and installation instructions for approval.

B. The following information shall also be submitted:

1. The manufacturer's certificates.
2. Data Curves: Performance data curves showing pressure, capability, horsepower demand, and speed over the entire operating range of the units(s).
3. Motor Information: Complete motor nameplate data as defined by NEMA, the manufacturer, and any motor modifications. For energy-efficient motors, provide a certified copy of the test report for a similar motor tested in accordance with NEMA MG 1-12.54 and IEEE 112, Test Method B, showing full-load efficiency meeting or exceeding specified values. Motors not as specified will be rejected.
4. The manufacturer shall supply an engineered blower selection showing the expected noise level of the blower without the enclosure and the attenuation rating for the enclosure in dBA.

C. Demonstrate meeting the design requirements described herein.

D. If it is impossible to conform to certain details of this Section due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Bearing Manufacturers Association (ABMA)

1. Bearing Life Specifications.

B. American Gear Manufacturers' Association (AGMA)

1. AGMA 2001:2004—Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
2. AGMA 6034-B92—Practice for Enclosed Cylindrical Wormgear Speed Reducers and Gearmotors.
3. AGMA 6035-A02—Design, Rating, and Application of Industrial Global Worm Gearing.

C. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A106/A106M—Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
3. ASTM A283/A283M—Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
4. ASTM A304—Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements.
5. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1,040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

D. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
2. ASME B40.100—Pressure Gauges and Gauge Attachments.

E. American Water Works Association (AWWA)

F. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.

G. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE 112—Standard Test Procedure for Polyphase Induction Motors and Generators.

H. National Electrical Manufacturers Association (NEMA)

1. Motor Design Standards and Standards for Control Enclosures.
2. NEMA MG 1—Motors and Generators Standards.

1.04 QUALITY ASSURANCE

A. All air blowers and appurtenances furnished under this Section shall be furnished by a single manufacturer who is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best industry practices and methods.

B. Routine tests shall be performed on representative motors and shall include the information described on NEMA MG 1-12.54 *Report of Test Form for Routine Tests on Induction Motors.* Efficiency shall be determined in accordance with IEEE 112, Method B.

C. Should equipment which differs from this Section be offered and determined to be the equal of that specified, such equipment will be acceptable only on the basis that any revisions in the design and/or construction of the structures, piping, appurtenant equipment, etc., required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

1.05 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall the meet the qualifications specified in Section 11000, General Equipment Requirements.

1.06 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the following spare parts in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.

a. One set of drive belts for the blower supplied.

b. One interchangeable set of sheaves for the PD blower.
c. One filter element for the inlet filter/silencer supplied.
d. Initial start-up supply and an additional 1-year supply of each lubricant required for the PD blower supplied shall be furnished. A list of approved lubricants shall be provided by the blower manufacturer that includes alternate approved lubrication products of other manufacturers, including specifications such as AGMA numbers, viscosity, etc.
e. Additional spare parts shall be provided in accordance with the recommendations of equipment manufacturers.

1.07 DEFINITIONS

A. *SCFM.* Standard cubic feet per minute is understood to be air at 68ºF, 14.7 pounds per square inch gauge (psig), and 36% relative humidity flowing at a rate of 1 cubic foot per minute.

B. *ICFM.* The volume of air in cubic feet per minute actually entering the blower inlet at the atmospheric condition specified.

C. *Discharge Pressure.* The pressure in psig measured at the blower discharge flange.

D. *Overall Efficiency*. The total efficiency for the motor, drive, and blower from the motor terminals to the pumped air.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. PD Blower: Equalization Basin, Air-Lift Pumps, and Re-Aeration Basin (Coarse Bubble Diffuser).
2. PD Blower: Aeration Basin and Aerobic Digester (Fine Bubble Diffuser).
3. PD Blower: Leachate Tank (Coarse Bubble Diffuser)

B. The PD blower shall be designed for the following conditions of service: the PD blower shall be capable of delivering the volume of air when operating at an elevation of 180 feet above sea level and inlet temperatures varying from 60°F to 95°F. The equipment manufacturer shall indicate separately the pressure, capacity, and horsepower demand with 60ºF and 90% relative humidity ambient air winter condition; 95ºF and 95% relative humidity ambient air summer

condition; overall efficiency at the guarantee point. Blower enclosures shall be suitable for outdoor installation.

C. Process Performance Requirements

1. PD Blowers – (Aeration and Aerobic Digester with Fine Bubble Diffusers) (Four: Two Duty and Two Swing):

a.	Delivered Airflow (SCFM):	950
b.	Inlet Pressure (psia):	14.63
c.	Discharge Pressure (psia):	10
d.	Differential Pressure (psi):	4.63
e.	Maximum Horsepower (hp):	75
f.	Maximum Blower Speed (RPM):	3,100
g.	Maximum Motor Speed (RPM):	1,800
h.	Minimum Efficiency (%):	50
i.	Sound Pressure Level with Enclosure (dB(A)): (Estimated sound pressure level at 1 meter, free field with soundproof piping.)	<75
j.	Voltage	230/460V
k.	Phase	3
l.	Hertz	60
m.	Installation Location:	As shown on the Drawings.

psia = pounds per square inch absolute; psi = pounds per square inch; RPM = revolutions per minute; dB(A) = A-weighted decibels.

2. PD Blowers – (Equalization Basin, Airlift Pumps, Re-Aeration with Coarse Bubble Diffusers) (Two Duty):

a.	Delivered Airflow (SCFM):	300
b.	Inlet Pressure (psia):	14.63
c.	Discharge Pressure (psia):	10
d.	Differential Pressure (psi):	4.63
e.	Maximum Horsepower (hp):	25
f.	Maximum Blower Speed (RPM):	4,200
g.	Maximum Motor Speed (RPM):	3,600
h.	Minimum Efficiency (%):	50
i.	Sound Pressure Level with Enclosure (dB(A)): (Estimated sound pressure level at 1 meter, free field with soundproof piping.)	<70
j.	Voltage	230/460V

k.	Phase		3
l.	Hertz		60
m.	Installation Location:	As shown on the Drawings.	

3. PD Blowers – Leachate Tank with Coarse Bubble Diffusers (Two Duty):

a.	Delivered Airflow (SCFM):	250
b.	Inlet Pressure (psia):	14.63
c.	Discharge Pressure (psia):	12
d.	Differential Pressure (psi):	2.63
e.	Maximum Horsepower (hp):	25
f.	Maximum Blower Speed (RPM):	2,700
g.	Maximum Motor Speed (RPM):	1,800
h.	Minimum Efficiency (%):	52.1
i.	Sound Pressure Level with Enclosure (dB(A)): (Estimated sound pressure level at 1 meter, free field with soundproof piping.)	<75
j.	Voltage	230/460V
k.	Phase	3
l.	Hertz	60
m.	Installation Location:	As shown on the Drawings.

2.02 ACCEPTABLE MANUFACTURER

A. The blower assembly package, including frame, base, and sound-limiting enclosure, shall be as manufactured by:

1. Aerzen USA Corp.
2. Or Engineer-approved equal.

2.03 EQUIPMENT

A. Blower Assembly Frame and Base

1. A common base and frame shall be supplied with the blower assembly with provisions on which to mount the blower, drive, motor, intake silencer with filter, discharge silencer, and sound limiting enclosure. The base shall be welded fabricated-steel construction, suitably reinforced.
2. The motor-mounting base shall include all necessary provisions to permit proper blower/motor alignment. For V-belt drive unit(s), motor-mounting bases shall be the adjustable two-rail type or pivoting base alignment, each rail having a corresponding threaded rod to facilitate alignment and drive belt replacement/tensioning.

B. Blower

1. The blower shall be the three-lobe, two-impeller, belt-driven, rotary positive-displacement type, with top inlet and bottom outlet. The blower shall be frame-mounted with intake silencer, blower, motor, and discharge silencer. Blower output shall be regulated by motor speed and the provided motor sheaves and drive belts by interchangeable motor and blower sheaves and corresponding drive belts.
2. The blower casing shall be of one-piece construction with separate head or side plates. Casings and head/side plates shall be made of close-grained cast iron suitably ribbed to prevent distortion under the specified operating conditions. Inlet and outlet connections shall be flanged or threaded and shall be an integral part of the blower casing.
3. The impellers shall be the straight, three-lobe type and shall operate without rubbing or liquid seals or lubrication. Impellers shall be constructed of ductile iron or close-grained cast iron, suitably ribbed internally. All impellers shall be statically and dynamically balanced and machined on all exterior surfaces for operating at close tolerances. The impellers shall be attached to forged, machined alloy-steel shafts by flanges, or shafts may be an integral part of the impeller. Shafts shall be of one-piece straight-through design or two-piece design designed to withstand all operating loads imposed.
4. The impellers shall be positively timed by a matched pair of timing gears. Timing gears shall be designed and manufactured for continuous service in accordance with AGMA Standards. Timing gears shall be fully machined from alloy steel, bolted to timing hubs, and adjustable for field retiming. Timing hubs shall be splined to the shaft and locked in place by a suitable lock nut.
5. Each impeller and shaft assembly shall be supported at each end by double-row spherical bearings. All bearings shall have a rating life of 100,000 hours as defined by ABMA Standards.
6. Lubrication to the timing gears and gear-end bearings of each blower shall be maintained by an oil bath relying on gears to splash lubricate all moving parts. The oil system shall have sufficient capacity and cooling provisions to provide adequate oil to the gears and bearings with a continuous service interval between oil changes of not less than 2,000 hours. High-temperature Viton oil seals shall be provided to prevent lubricant from leaking into the air stream or into the atmosphere. The drive end bearings shall be grease lubricated through exterior grease fittings.
7. Sight glasses shall be provided for oil level observation. Each sight glass shall be able to indicate that a safe oil level exists during blower operation and accurately indicate the amount of oil present when the blower is off.

2.04 ACCESSORIES

A. Lifting Lugs

1. Where practical or applicable, individual equipment and/or each component part over 100 pounds shall be provided with lifting lugs for easy handling.

B. Intake Filter

1. The blower shall be furnished with a dry-type element inlet filter. The filter medium shall be paper filter media capable of filtering 2-micron solids with a 99.5% solids-retention efficiency with a pressure drop of less than 2 inches of water column.

C. Inlet Silencers

1. The inlet silencer shall be heavy-duty, welded-steel construction, two-chamber absorptive type. The silencers shall provide attenuation suitable for critical pitch line velocity applications.
2. Pressure drop through the inlet silencer shall be minimal.
3. The inlet silencers shall be capable of handling the conditions specified in Paragraph 2.01C.

D. Discharge Silencers

1. The discharge silencers shall be heavy-duty, welded-steel type construction, with or without absorptive materials. The silencers shall provide attenuation suitable for critical pitch line velocity applications.
2. The blower discharge silencers shall be capable of handling the conditions specified in Paragraph 2.01.

E. Pressure-Relief Valves

1. The Contractor shall provide a spring or weighted discharge pressure-relief valve installed on the discharge silencer. This valve is to be set to relieve at 1 psig above the blower maximum operating pressure and shall be factory set and tested during the shop performance test.

F. Check Valve

1. Provide wafer, cast-iron body, disc-type check valve for mounting on blower discharge piping. Furnish a valve with Type 304 stainless steel internals, Type 304 stainless steel spring, and Teflon seat material.

G. Discharge Butterfly Valve

1. Provide a wafer body, resilient-seated, lever-operated, tight-closing butterfly valve for positively isolating the blower from the discharge manifold piping. Furnish a valve with cast-iron body, ductile-iron disc, Type 316 stainless steel valve stem and disc screws, Teflon seat, acetal stem bushing, Buna N O-ring and stem packing, and aluminum lever. Valves shall be as manufactured by Pratt, DeZurik, Watts Regulator Industries, Inc., or an Engineer-approved equal,

H. Vibration Isolator Pads

1. Provide molded, synthetic rubber and cork, vibration-isolation pads for the blower enclosure. Vibration-isolation pads shall be sized to fit the enclosure structural steel base.

I. Inlet Vacuum Gauge

1. The Contractor shall furnish and field install a differential pressure gauge to indicate pressure drop through the air filter at the PD blower:

    a. Range: 0 to 10 inches water gauge.
    b. Accuracy: 2% of full scale.
    c. Dial: 4 inches, 120° scale, .20 WC minor divisions.
    d. Mounting: Vertical.
    e. Construction: Die-cast aluminum case, silicone rubber diaphragm, calibrated range spring, samarium-cobalt magnehelic of high-magnetic permeability mounted in sapphire bearings, clear plastic cover with O-ring seal and zeroing screw, litho-painted scale, and red-tipped pointer with rubber pointer stops.
    f. Gauges shall be Dwyer Instruments, Inc. Model 2010, or Engineer-approved equal.

J. Discharge Pressure Gauge

1. The Contractor shall furnish and field install a glycerin-filled pressure gauge at the blower discharge.

    a. Range: 0 to 15 psi.
    b. Accuracy: 2% of full scale, maximum.
    c. Dial: 2-1/2-inch-diameter 270° scale; heavy-gauge aluminum with white background and black markings; 0.25-psig minor divisions.
    d. Case: Stainless steel.

e. Ring: Stainless steel.
f. Movement: Stainless steel.
g. Bourdon Tube: Phosphor bronze, large bore tubing which is silver soldered to socket and tip.
h. Connection: Forged brass 1/4-inch NPT black connection.
i. Gauges shall be WIKA Model 233.53 or similar, Ashcroft Type 1009, or approved equal.

K. Blower Enclosure

1. The blower package supplier shall supply and include in the contract price a blower assembly enclosed within an acoustical sound-limiting enclosure that covers the blower to limit noise equal to or less than the values indicated in Section 2.01.C at 3 feet in a free field environment. The enclosure shall have removable surface panel held closed with half-turn compression latches. The interior will be lined with polyester acoustic foam, of a thickness required to give the desired attenuation, held in place by high-temperature adhesive and clamps. The foam shall have an oil-resistant inner covering. Weather/sound seals will be fitted on all enclosure penetrations. The enclosure shall be suitable for outdoor exposure in Florida and constructed with an internal painted steel frame with powder-coated galvanized sheet steel, stainless steel fasteners, and stainless steel hinges and latches for exterior panel doors. The enclosure shall be factory installed on the base. The enclosure shall be Attenu-Pac Full Package Enclosure as manufactured by Aerzen USA Corporation, or approved equal.
2. The blower enclosure shall be fitted with a weather hood-covered intake sized for the maximum airflow specified in Paragraph 2.01.C.

L. Lubrication and Special Operating Supplies

1. Lubrication oil shall be the manufacturer's approved synthetic high-temperature-duty type (e.g. Mobil 1) as manufactured by Mobil Oil Company or approved equal.

2.05 MOTORS AND DRIVERS

A. Motors

1. The blower's motors shall be rated for the horsepower and nominal motor speed indicated in Paragraph 2.01.C. Motors shall be of the open drip-proof type with 1.15 service factor. The motor shall be premium efficiency.

2. The horsepower rating of all motors shall accommodate all brake horsepower conditions of blower performance without exceeding the temperature rating of the motor windings.

B. Belt Drive

1. The blower shall be driven by a constant-speed V-belt drive assembly, equipped with integral electric drive motor and motor support. The drive assembly shall employ a belt transmission consisting of two pulleys or sheaves connected by a V-belt. The output speed of the drive shall be capable of being changed by replacement of the pulleys or belt sheaves. All rotating surfaces shall be enclosed by a removable guard. The drive assembly shall have a service factor of 1.15.

C. A variable-frequency drive shall be provided for each of the blowers.

2.06 HEARING PROTECTION (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the equipment in the locations as shown on the Drawings and in accordance with the manufacturer's instructions and recommendations and the approved shop drawings. Installation shall include furnishing the required lubricants for initial operation. The grades of lubricants shall be in accordance with the manufacturer's recommendations.

3.02 PAINTING AND SURFACE PREPARATION

A. Surface preparation, shop painting, field painting, and other pertinent detailed painting specifications shall be in accordance with Section 09900, Painting and Coating.

3.03 SHOP TESTING

A. The blower shall be statically and dynamically balance tested at the factory. The blower shall receive a certified slip test in accordance with the PCT-9 test code of the American Society of Mechanical Engineers. A test report confirming capacity shall be furnished complete with data and calculations. The test consists of blanking off discharge and measuring the speed of the blower to maintain discharge pressure of 1 psig. Also recorded shall be inlet temperature, barometer, and discharge gauge pressure. Slip RPM recorded shall be corrected by formula in PTC-9 (latest revision) to specified performance requirements.

B. The blower shall be given a factory mechanical test to ensure mechanical integrity. If the test indicates that adjustments are necessary to ensure conformance with specifications, such adjustments shall be made before shipment.

3.04 FIELD TESTING

A. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing, startup testing, and final mechanical performance testing specified in this Section and in Section 11000, General Equipment Requirements. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. Field tests shall be made in conformance with Section 01600, Materials and Equipment. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements. The specified time for these services shall be as shown in Section 11000, Table 11000-1, Equipment Testing and Training Requirements. If additional service is required due to the equipment not being fully operational at the time of service requested by the Contractor, the additional service days shall be at the Contractor's expense.

1. The factory-authorized service representative shall be onsite to perform the testing services specified in this Section in accordance with Table 11000-1, Equipment Testing and Training Requirements.

2. Pre-Startup Testing:

    a. Visually inspect the blowers and certify that the motor has been furnished in accordance with the Specifications in this Section as to horsepower, maximum input torque (100% rated load), voltage, phase, and hertz.
    b. Visually inspect and verify that the incoming electrical service and controls have been installed in accordance with the manufacturer’s recommendations.
    c. Verify that the blower control panel has been furnished with all of the controls and alarms specified in this Section and has been installed in accordance with the manufacturer’s recommendations.
    d. Verify that the units have been properly installed and are in proper alignment.
    e. Verify that there are no mechanical defects in any of the parts

3. Startup Testing:

a. The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.

b. With the EQ Basins, Aeration Basins, and Aerated Digesters filled to the maximum water surface elevation shown on the Contract Documents, verify:

(1) That the units operate without overheating or overloading of any parts and without objectionable vibration.
(2) That the blowers can deliver the specified pressures and air flow rates.
(3) That the controls meet the performance requirements stated in this Section.
(4) That the alarms and safety shutdowns have been installed in accordance with the Contract Documents and the manufacturer's recommendations. These features shall be checked by artificially simulating an alarm and/or safety shutdown or control condition.

4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

5. Final acceptance depends on the satisfactory operation and performance after installation.

3.05 TRAINING SERVICES

A. The factory-authorized service representative shall be onsite to perform training services in accordance with Section 11000, General Equipment Requirements, Table 11000-1, Equipment Testing and Training Requirements.

3.06 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. The equipment manufacturer shall provide a written report covering findings and installation approval. The report shall describe all inspections and any deficiencies noted and shall be mailed directly to the Engineer.

END OF SECTION

SECTION 11390
FIELD-ERECTED BIOLOGICAL NUTRIENT REMOVAL
WASTEWATER TREATMENT PLANT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to provide a field-erected biological nutrient removal (BNR) activated sludge wastewater treatment plant (WWTP) as two mirror-image, field-erected package units with welded steel walls and bulkheads as specified in this Section and shown on the Drawings. As noted herein as "provided by others" indicates that equipment is provided by the Contractor and a different manufacturer from that providing the field-erected BNR WWTP. A field-erected WWTP with bolted steel walls and bulkheads will not be acceptable as an equal and the product shall be complete with all appurtenances necessary to make the equipment complete and operable in compliance with the following Specifications.

B. The BNR WWTP will be configured in a 4-Stage Configuration (Pre-Anoxic-Aerobic-Post-Anoxic and Re-Aeration) configured with Influent Equalization Tanks, Pumps and Internal Recycle Pumping to meet low-level Total-N of less than or equal to 3.0 mg/L to meet the Santa Fe Basin Management Action Plan requirements.

C. Each treatment unit shall consist of the following treatment zones:

1. Two Rotary Drum Screens with Discharge Conveyor (provided by others) and Backup Manual Bar Screen.
2. One Influent Equalization Basin Zone with a coarse-bubble diffused aeration system.
3. One Pre-Anoxic Mixing Zone and Two Pre-Anoxic Basin Zones with submersible mixers.
4. One Aeration Basin Zone with baffled zones to mimic plug-flow reactor (with a fine-bubble diffused aeration system provided by others).
5. One Secondary Anoxic Basin Zone with submersible mixers.
6. One Re-Aeration Zone with a coarse-bubble diffused aeration system.
7. One Secondary Clarifier with Control Panel.
8. One Aerobic Digester Zone (with a fine-bubble diffused aeration system provided by others).
9. Horizontal End Suction Pumps – EQ and Mixed Liquor Recycle (Internal Recycle) and external piping (provided by others).

10. Supplemental Carbon Feed System (provided by others) to feed Micro C from 350-gallon totes into the Second Anoxic Basin to improve denitrification efficiency (as needed).

1.02 SUBMITTALS

A. The WWTP shall include as a minimum the components described in the following pages of this Section. Interested WWTP manufacturers may submit, provided the conditions of the following *Qualifications* are met.

1. A WWTP manufacturer is allowed to submit a bid on their system provided the system has been pre-approved as an equal by the Engineer. The Engineer has sole discretion whether the system proposed, and submitted on, is an equal to the system specified.

B. Full-dimensioned shop drawings including manufacturer's descriptive literature and installation instructions shall be submitted for all equipment, electrical wiring and conduit, control panel schematics, tankage, piping, valves, hand-railing system, access stairs, and all other materials furnished under this Section. Structural shop drawings signed and sealed by a Professional Structural Engineer licensed in Florida shall be submitted for all structural elements, including tanks, walkways, handrails, equipment-mounting hardware, grating, elevated platform, supports, and access stairs.

C. Complete product and manufacturer's data shall be submitted for all equipment, electrical components, wiring and conduit, control panel components, tankage, piping, valves, hand railing, access stairs, coating systems, and all other materials furnished under this Section or related Section as required for construction of the treatment unit.

D. The treatment unit manufacturer shall perform all calculations and obtain information from the Contractor as required for Contractor-supplied process equipment for manufacturer to submit engineering calculations for the following items:

1. Hydraulic Calculations: Provide calculations of water surface elevations for each compartment of the treatment unit as furnished. Include a hydraulic profile drawing of the treatment unit that indicates and identifies all hydraulic elements including interconnecting piping, flow ports, and appurtenance between compartments. Water surface elevations shall be computed and illustrated for each compartment at (1) the influent maximum monthly average daily flow (MMADF) condition with a return-activated sludge (RAS) flow equal to 150% of annual average daily flow (AADF) and a mixed liquor recycle (MLR) flow equal to four times

AADF as specified in Article 2.01 of this Section, and (2) the influent peak hourly flow (PHF) condition with an RAS flow equal to 80% to 100% of AADF and an MLR flow equal to three times AADF.

2. Air Distribution Piping Calculations: Provide sizing calculations for low-pressure air-supply (LPA) piping that indicate actual air flow rates (acfm), actual air flow velocities (fpm), and corresponding pressure drops (psi) in the air distribution piping system. Include pressure-loss computation starting at the treatment unit's inlet to the air distribution main header piping to the farthest point of air application (e.g., drop-leg connection piping). Calculations shall include design basis criteria and site conditions criteria specified in this Section.
3. Provide electrical calculations for electrical loads and other electrical requirements.

E. The following information shall also be submitted:

1. Drawings showing dimensions and details of all steel units and minimum recommended spacing.
2. Control details and electrical wiring diagrams.
3. Performance data including, but not limited to, motor data, and air diffuser design criteria.
4. Installation list of similar installations.
5. All other information necessary to enable the Engineer to determine whether the proposed equipment meets the specified requirements.

F. Demonstration of meeting the design requirements described herein.

G. If conforming to certain details of this Section is impossible due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Process and hydraulic design shall be in accordance with the requirements of:

1. Florida Administrative Code (FAC)

a. Chapter 62-600—Domestic Wastewater Facilities.
b. Chapter 62-601—Domestic Wastewater Treatment Plant Monitoring.

c. Chapter 62-610—Reuse of Reclaimed Water and Land Application.

2. Unites States Environmental Protection Agency (USEPA)

a. Recommended Standards for Wastewater Treatment Facilities (10-State Standards).
b. Design Criteria for Mechanical, Electrical and Fluid System, and Component Reliability, Latest Edition.

B. Structural design shall be in accordance with the requirements of:

1. American Concrete Institute (ACI)

a. ACI 318-99—Building Code Requirements for Structural Concrete.

2. American Society of Testing and Materials (ASTM)

a. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
b. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
c. ASTM A536—Standard Specification for Ductile Iron Castings.

3. American Welding Society (AWS)

a. AWS D1.1/D1.1M—Structural Welding Code—Steel.

4. Florida Building Code (FBC)

5. American Institute of Steel Construction (AISC)

a. AISC Steel Manual.

C. Electrical design shall be in accordance with the requirements of:

1. National Electrical Manufacturers Association (NEMA)

a. ANSI/NEMA MG 1—Motors and Generators.

2. National Fire Protection Association (NFPA)

a. NFPA 101—National Electric Code.

D. General design standards shall be in accordance with the requirements of:

1. All local, State, and Federal requirements.
2. Hydraulic Institute (HI) standards.
3. Occupational Safety and Health Administration (OSHA) Standards.
4. Underwriters Laboratories (UL) standards.

1.04 QUALITY ASSURANCE

A. The treatment unit manufacturer shall be responsible for designing the hydraulic, process, structural, electrical, instrumentation, mechanical, and controls for equipment furnished, coordination of piping connections and mechanical equipment loads (for related BNR WWTP equipment supplied by others and required for this BNR WWTP), as well as fabricating and erecting the treatment units. The Contractor shall be responsible for providing equipment supplied by others and meeting equipment requirements of the treatment units and providing what is necessary to guarantee satisfactory treatment performance under loading conditions specified in this Section. The Contractor shall be responsible for and design and/or additional materials/ equipment necessary to coordinate yard piping, electrical systems, process controls and SCADA with the treatment unit configuration as supplied by the treatment unit manufacturer.

B. The manufacturer shall be responsible for the design of the package treatment unit specified in this Section. The design shall include all equipment necessary for the effective operation of the treatment units including but not limited to:

1. Steel tankage and base channels.
2. A pre-anoxic mixing zone as shown on the drawings to allow mixing of the raw wastewater from EQ pumps, the MLR from the Internal Recycle Pumps and Return Sludge from the RAS air-lift pump. A baffled mixing zone volume of 7,000
3. Submersible mixers in pre-anoxic and secondary anoxic zones.
4. Main air headers and connections for the fine-bubble diffusers shut-off valves and drop-legs in the aeration zone and aerobic sludge digesters.
5. Main air headers, coarse-bubble diffusers, and drop-piping connections in equalization basin zones and re-aeration zones.
6. Pump flanged piping connections to the exterior tank wall for the following pump systems (supplied by others): EQ, MLR (internal recycle), and sludge pump.
7. Secondary clarifier equipment including effluent weirs/launders, baffles, sludge collector mechanisms, scum skimmer assemblies, gear box and NEMA 4X SS electrical control panel.

8. Air-lift pump equipment and piping for RAS, waste-activated sludge (WAS), and decant from aerobic digester.
9. Internal and interconnecting piping, valves, and fittings.
10. Internal drain piping and exterior flanged pipe connections.
11. Isolation gates and/or eccentric plug valves.
12. Elevated platform, stairway, interconnecting bridge, walkways, railings, and handrails.
13. Control panel for clarifiers with motor starters, electrical wiring, conduit, disconnects mounted on the treatment unit, lighting structural supports.
14. Other miscellaneous associated items required for a complete and operational system.

Unless otherwise noted in this Section, items listed in the paragraph above shall be furnished and installed by a single treatment unit manufacturer as a supplier to the Contractor.

C. The treatment unit manufacturer shall furnish the aeration drop legs and coarse-bubble diffusers as specified in this Section. The coarse bubble aeration drop legs, diffusers, butterfly valves and related appurtenances shall be installed by the treatment unit manufacturer.

D. If equipment that differs from this Section is offered and determined to be the equal of that specified, such equipment will be acceptable only on the basis that any revisions in the design and/or construction of the structures, piping, appurtenant equipment, etc., required to accommodate such a substitution shall be made at no additional cost to the Owner and be as approved by the Engineer.

1.05 WARRANTY

A. The Manufacturer shall furnish its standard warranty against defects in material and workmanship for all equipment provided by Seller under this Section. The Seller shall warrant the equipment, or any components thereof, through the earlier of:

1. 12 months from the date of project substantial completion and operation of the equipment and facility.

B. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the equipment manufacturer shall not be acceptable. The equipment manufacturer shall be solely responsible for the warranty of the equipment and all related components.

C. If a component fails to perform as specified or proven defective in service during the warranty period, excluding items of supply normally expended during

operation, the manufacturer shall provide a replacement part without cost to the Owner.

D. This warranty shall be valid only if the equipment is properly maintained and operated in accordance with the manufacturer's instructions.

1.06 QUALIFICATIONS

A. The treatment unit shall be supplied by a manufacturer that has been engaged in the design, fabrication, assembly, testing, start-up, and service of field-erected domestic wastewater treatment units of a similar size and type operating in the United States for a minimum of 10 years. The manufacturer shall have a minimum of 10 similarly configured treatment units, which are operating satisfactorily at the time of the bid for this project. The manufacturer shall furnish, upon request, supporting evidence of such active experience to include facility names, sizes, and telephone contacts.

1.07 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the following spare parts in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.

    a. Initial start-up supply and an additional 1-year supply of each lubricant required for clarifier gear box. A list of approved lubricants shall be provided by the manufacturer that includes alternate approved lubrication products of other manufacturers, including specifications such as AGMA numbers, viscosity, etc.
    b. One box of fuses of each type.
    c. Spare clarifier chain for chain and sprocket drive.
    d. Additional spare parts shall be provided in accordance with the recommendations of equipment manufacturers.

1.08 DESIGN REQUIREMENTS

A. All components supplied shall conform to the size requirements as set forth in the plans, to the requirements included in other sections of these Specifications, and to the broad design parameters as described in this Section.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. The welded steel field-erected WWTP shall be designed for the following conditions of service: the sewage treatment plant shall consist of two complete concentric circular welded steel tanks, and the necessary welded steel division walls to ensure process operation. The inner circular tank shall serve as the settling or clarifier basin and the annular space between the inner and outer circular walls shall be divided into the required process compartments. Inner and outer wall diameters shall be as shown on the plans and will be considered minimum required diameters. Water depths and tank columns shall be as discussed in this specification and shown on the Drawings.

B. In addition to the above-mentioned equipment, the following principal items of equipment shall be included:

1. Raw Influent Structure with Manual Bar Racks as Backup to Rotary Drum Mechanical Screens .
2. Process Mixing System(s).
3. Piping Connections of EQ Pumping, Internal Recycle and Sludge Pumping Systems.
4. Connections for Blowers and Internal Air Distribution Systems for Fine and Coarse Bubble Systems and Air-Lift Pumps.
5. Baffled zones within the Pre-Anoxic, Aeration and Secondary Anoxic Zones.
6. Clarifier Effluent Launderer and Scum Baffle.
7. Scum Control System.
8. Clarifier Sludge Collector Mechanism.
9. Return Sludge and Waste Sludge Systems.
10. Supernatant Decant System.
11. Access Bridge and Stairway.
12. Equipment Access Walkways.
13. Internal Piping.
14. Electrical Controls.
15. Surface Prep and Coating.
16. Warranty.

C. Basis of Design and Process Performance Requirements

1. Raw Wastewater Flow and Quality for Average Annual Daily Flow Basis:

a.	Minimum Wastewater Temperature:	60° F (16° C)
b.	Site Elevation:	180 ft. NAVD 1988

c.	Average Daily Flow (MGD):	0.500
d.	PHF Rate (MGD):	1.500
e.	Influent CBOD5 (mg/L):	300
f.	Influent TSS (mg/L):	300
g.	Influent NH_3-N (mg/L):	45
h.	Influent TKN (mg/L):	60
i.	Influent NO_3-N (mg/L):	---
j.	Influent Total-P (mg/L):	7.0

2. Field-Erected BNR WWTP- Reclaim Water Effluent Limits (Annual Avg. Basis) Required for Discharge to Reuse Spray Land Application System

a.	Effluent CBOD5 (mg/L):	20.0
b.	Effluent TSS (mg/L):	20.0
c.	Effluent NH_3-N (mg/L):	0.1
d.	Effluent NO_3-N (mg/L):	1.5
e.	Effluent Refractory Org-N (mg/L):	1.0
f.	Effluent Total-N (mg/L):	$\leq$ 3.0
g.	Effluent Total-P (mg/L):	Report

MGD = million gallons per day;
BOD = biological oxygen demand; mg/L = milligrams per liter;
TSS = total suspended solids; NH_3-N = ammoniacal nitrogen
NO_3-N = Nitrate nitrogen; Org-N = organic nitrogen;
Total-N = total nitrogen

3. Process Treatment Variables – Basis of Design

a.	MLSS	4,000 mg/L
b.	MLVSS	3,000 mg/L
c.	D.O. – Aerobic Basin	2.0 mg/L
d.	D.O. – Anoxic Basins	0.10 mg/L
e.	Total SRT	20 days
f.	Aerobic SRT	13 days
g.	Anoxic SRT	7 days

4. Field-Erected BNR WWTP Minimum Diameters and Volumes Per Mirror Image Treatment Train:

a.	Plant Height with 1.5-ft of Freeboard	20.5 feet
b.	Overall Tank Diameter	81 feet
c.	Equalization Basin (gallons)	211,000
d.	Pre-Anoxic Basin No. 1 (gallons)	37,000

e.	Pre-Anoxic Mix. Zone (gallons)	7,000(*)
f.	Pre-Anoxic Basin No. 2 (gallons)	37,000
g.	Aeration Basin (gallons)	187,200
h.	Secondary Anoxic Basin (gallons)	35,000
i.	Re-Aeration Basin (gallons)	5,000
j.	Secondary Clarifier Basin (diameter)	33.5 feet
k.	Aerobic Digester Basin (gallons)	81,000

Notes: (*) Locate within Pre-Anoxic Zone No. 1

2.02 ACCEPTABLE MANUFACTURER

A. The Field-Erected BNR WWTP package, including all equipment described in this specification, shall be as manufactured by:

1. Evoqua Water Technologies LLC, Thomasville, GA.
2. Or Engineer-approved equal.

2.03 EQUIPMENT

A. Treatment Unit Structural Components

1. All vertical steel bulkheads designated as hydrostatic on the Drawings and the inner circular wall shall be designed to withstand full hydrostatic forces from either side of the bulkhead or wall. The design of the walls shall be such that any isolated compartment may be individually dewatered. The minimum wall plate thickness shall be 1/4 inch.
2. Bulkheads shall be reinforced and designed as partially fixed connections at the inner and outer walls. All bulkheads and walls shall have reinforcing structural members at the top of the section. These members will be designed to maintain the required shape of the item while under any combination of load applications that could be encountered under actual field conditions.
3. The circular clarifier wall shall be designed per AISC with reinforcing calculated based on a freestanding tank under external pressure. Since future modifications or relocation of the unit could result in the deletion of a bulkhead(s), any method of design other than a freestanding tank will not be acceptable.
4. All shop welds shall have burrs, spatter, etc. removed before blasting. All chain or skip welds on surfaces above water level or on an outer surface shall be caulked before painting.
5. All reinforcing on the bulkheads and circular walls shall be gusseted to develop the full strength of the reinforcing.
6. The outer circular steel wall shall be of a thickness designed to withstand a full hydrostatic internal loading causing hoop stress of less than 24,000 psi

with a weld efficiency of 75%. The minimum wall plate thickness shall be 1/4 inch.

7. The outer circular steel tank wall shall also be designed for a wind load of 100 miles per hour. A minimum 1/4-inch-thick steel reinforcing wind girder shall be provided and installed completely around the top of the outer wall as shown on the Drawings. The wind girder shall be gusseted to develop the full strength of the reinforcing girder. The reinforcing wind girder shall be calculated based on a freestanding tank under external pressure. Since future modifications or relocation of the unit could result in the deletion of a bulkhead(s), any method of design other than a freestanding tank will not be accepted.
8. The full tank height of the plant walls and bulkheads shall be 20.5 feet tall and shall be developed using no more than two vertical steel sheets of plate to ensure the ease of field installation and to avoid aesthetically any extra weld seams.
9. The method used to initially fill the plant with liquid may be selected by the Engineer to test the hydrostatic design. Any failure or excessive deflection shall be remedied, and all costs shall be borne by the manufacturer.

B. Plant Fabrication and Installation

1. Each plant component shall be prefabricated in the factory of the manufacturer and shall be shipped in assemblies complete and operable as detailed on the Drawings and specified herein. Each component assembly shall be erected in the field in accordance with the manufacturer's installation Drawings.
2. The field installation shall be performed by the equipment manufacturer's personnel directly employed by the equipment manufacturer and normally engaged in the field installation of the equipment specified herein.
3. Field welding shall be in accordance with the latest edition of AWS D1.1. Field welding shall be in the flat, horizontal, and vertical down positions, no back gouging, with E60 and E70 electrodes.
4. Any field welding accomplished on surfaces down to a point 2 feet below the top of the plant shall have weld spatter and burrs removed by chipping and grinding to prevent operator injury. Any accessories mounted on or attached to the exterior of the tank and supplied by the plant manufacturer will be considered part of the treatment plant manufacturer's erection responsibility.
5. The plant manufacturer shall also be responsible for furnishing all necessary construction equipment for erection of the plant as supplied by the manufacturer. Installation shall encompass the total treatment plant assembly including but not limited to handrails, diffusers, drop pipes, scraper assembly, and weir/scum baffle assembly. Installation/erection

shall also include leveling and adjusting the weir plates and scraper assembly.

6. Field painting of the plant and any accessories mounted on or attached to the exterior of the tank and supplied by the manufacturer shall be performed by the equipment manufacturer and shall include masking of all aluminum, galvanized steel, and stainless-steel surfaces. Clean up of all sand and debris from blasting shall also be included. Field painting may be subcontracted provided the equipment manufacturer maintains overall responsibility and warranty for the field painting.
7. These requirements shall be met so that discrepancies between the erector and manufacturer will be totally avoided with the result being a trouble-free installation with single source responsibility for the finished product.

2.04 GENERAL COMPONENT CONSTRUCTION

A. A steel base channel rolled to the circular dimension of the inner and outer walls shall be provided for installation into the slab. In addition, a steel base channel shall be provided for each bulkhead. These channels shall be ASTM A36, 8-inch-x-13.75 pounds/foot (lb/ft) and/or 8-inch-x-18.75 lb/ft and shall be embedded 4 inches deep in the slab. Base ring hooks shall be provided for the outer wall and hydrostatic bulkhead base channels. The Contractor shall be required to field weld the hooks to the base ring channels in accordance with manufacturer's instructions and acceptance. Delivery of the base channels and base ring hooks shall be coordinated with the Contractor and furnished with detailed installation drawings. The base ring channels shall be used as a base for welding the upright steel walls and bulkheads of the treatment plant. A keyway in the slab shall not be required or accepted as equal.

B. A steel trim channel rolled to the circular dimension of the inner and outer walls shall be provided to form the top wall perimeter. A trim channel shall also be provided for the top of each bulkhead. These channels shall be ASTM A36, 4-inch-x-5.4 lb/ft.

C. The annular space between the inner tank wall and the outer circular wall shall be divided into distinct zones as shown on the Drawings. Each zone shall be sized to accommodate the volumes shown on the plans and described in this Specification.

D. 4-inch-diameter Schedule 40 flanged drain nozzle stub-outs x 12 inches long shall be provided on the exterior of the plant outer wall near the bottom of the tank as determined by the Manufacturer.

E. The following exterior mounted pump connections to the tanks shall be provided: 4-inch-diameter Schedule 40 flanged pipe suction stub-outs x 12 inches long for horizontal end-suction EQ Pumps; 6-inch-diameter Schedule 40 flanged pipe

suction stub-outs x 12 inches long for horizontal end-suction MLR (IR) Pumps; and 8-inch-diameter Schedule 40 flanged pipe suction stub-outs x 12 inches long for the progressive cavity Sludge Pumps shall be provided on the exterior of the plant outer wall near at the elevations determined by the Contractor and Manufacturer and as approved by the Engineer.

F. The influent structure shall be fabricated from 3/16 inch minimum thickness, Type 304 stainless steel plate. The structure shall be located as shown on the Drawings and shall be accessible for ease of maintenance and be operated as a backup to the two Rotary Drum Mechanical Screens.

G. The influent structure shall be sized as required for the specified PHF rate. A Type 304 stainless steel bar screen with drying deck shall be provided in the influent box and shall trap solids greater than 1 inch in diameter.

H. The air distribution system shall consist of a peripheral air header, diffuser drop pipes, and diffuser assemblies.

I. The peripheral air header shall form a complete circle around the periphery of the settling tank wall. The air header shall be designed to minimize head loss and provide an even distribution of air to all aerated compartments. The Contractor and Manufacturer shall coordinate and install the main air header from the blowers shall be placed over the top of the tanks wall to prevent siphoning water back into blowers. Drop-pipe connections shall be placed on the outside of the air header such that the drop pipe will project down the outside of the settling tank wall. The air header shall be fabricated from steel tubing, mitered so that the sections encompass 360 degrees.

J. Each drop-pipe assembly shall consist of a union to allow for ease of removal, a lever-operated bronze ball valve accessible from the walkway for shut off and regulation of air supply, and the necessary pipe and fittings. The submersible portion of the drop-pipe assembly shall be of corrosion-resistant aluminum construction and shall be easily removable for inspection or service by one person without the aid of a mechanical hoist.

K. An aluminum diffuser header shall be provided to attach to the bottom of the drop-pipe assembly. The aluminum diffuser headers shall be fabricated with a sufficient number of outlet connections to receive the air diffusers specified and in quantity as required for proper plant operation. Two 1/4-inch-thick steel brackets shall be provided to support the diffuser header. The brackets shall project out from the vertical wall and shall be designed for ease in removal and installation of the diffuser assembly without draining the aeration tanks. The diffuser brackets shall automatically position and hold the drop-pipe assembly in place as shown on the Drawings.

L. The coarse-bubble air diffusers shall be a non-clog, multi-leaf spring design, each with a capacity of not less than 30 cubic feet per minute (cfm). The diffuser shall be fabricated of Type 304 stainless steel with a 0.20-inch minimum wall thickness.

M. Each coarse-bubble diffuser shall have three stainless steel leaf springs fastened to the body with 3/16 inch stainless steel blind rivets and each covering four 7/8-inch-diameter air discharge ports. The spring shall act as a check valve to eliminate plugging. The leaf spring deflects only slightly, oscillating at a high frequency, shearing the air as it is released to provide optimum bubble size and high oxygen transfer. The springs automatically produce a controlled backpressure to ensure uniform air discharge through the entire diffuser network without the use of air restrictors, balancing inserts, or orifices in the header system.

N. The EQ coarse bubble aeration system shall be designed based on an airflow rate of 10 cfm/1,000 cf of tank volume.

2.05 INFLUENT EQULIZATION BASIN

A. The EQ pumps and exterior piping shall be provided by others. Piping connections to the EQ tanks shall be provided as shown on the plans.

B. The flow regulator box shall be fabricated from 3/16-inch-thick Type 304 stainless steel plate. The box shall be accessible for ease of maintenance. The flow regulator box shall be sized as required for the specified flow rate.

C. The flow regulator box is designed to feed the plant at a metered rate under all pump conditions. At minimum pump conditions (one pump pumping with tank nearly empty), the broad weirs in the flow regulator box are to be set so that 3/4 Q (3/4 average daily flow in GPM) is flowing over the V-notch weir. The broad weirs in the box have been sized so that at maximum pump conditions (both pumps pumping with tank nearly full) a 0.1 foot rise will be over the broad weirs. The V-notch has been sized so that with this 0.1 foot rise over the broad weirs, 1.5 Q will be flowing over the V-notch weir.

2.06 PRE-ANOXIC BASINS

A. A Pre-Anoxic Mixing Zone shall be provided as a baffled area of approximately 7,000 gallons located within Pre-Anoxic Zone 1. It will receive discharge piping and flows from the EQ Pumps (raw wastewater), MLR Pumps and the RAS air-lift pump.

B. Each Pre-Anoxic Zone shall be provided with a submersible mixer to gently stir the tank contents. Velocity shall be so that settling of the tank contents does not occur but shall also prevent entrainment of air. Each mixer shall be complete with a Type 304 stainless steel guide rail system and hoist to raise and lower the mixer for service and inspection. Each mixer shall be driven by a 460-Volt, three-phase, 60-Cycle submersible air-filled motor. The mixer circulation capacity shall be capable of meeting facility influent flows between 0.100 to 1.5 MGD. Each mixer shall be capable of continuous submergence under water without loss of water tightness to a minimum depth of 20-feet.

B. Each mixer shall include a local control panel. The panel shall be NEMA 4X rated, 316 stainless steel suitable for a 480-volt incoming power supply. The panel shall include a flange type disconnecting means with a main breaker, CPT, running and temperature/moisture alarm LED indicators, on/off selector switch, elapsed time meter, alarm silence and reset pushbuttons, horn, and flasher. The panel shall include a NEMA rated motor starter with overloads, reset. All wiring shall be strained copper, 600 volts rated, identified at each end. Provide dry contacts for all status and alarm signals for remote monitoring. The panel shall be UL listed with a 14k SCCR rating.

2.07 AERATION BASINS

A. Each Aeration Zone shall be provided with a fine-bubble diffused-aeration system to aerate the tank contents.

B. The fine-bubble air diffusers shall be provided by others and shall be in accordance with Specification 11551, Fine-Bubble Diffused-Aeration System.

2.08 SECONDARY ANOXIC BASINS

A. Each Secondary Anoxic Zone shall be provided with a submerged mixer to gently stir the tank contents. Velocity shall be so that settling of the tank contents does not occur but shall also prevent entrainment of air. Each mixer shall be complete with a Type 304 stainless steel guide rail system and hoist to raise and lower the mixer for service and inspection. Each mixer shall be driven by a 460-Volt, three-phase, 60-Cycle, submersible air-filled motor. The mixer circulation capacity shall be capable of meeting facility influent flows between 0.100 to 1.5 MGD. Each mixer shall be capable of continuous submergence under water without loss of water tightness to a minimum depth of 20feet.

B. Each mixer shall include a local control panel. The panel shall be NEMA 4X rated, 316 stainless steel suitable for a 480-volt incoming power supply. The panel shall include a flange type disconnecting means with a main breaker, CPT, running and temperature/moisture alarm LED indicators, on/off selector switch,

elapsed time meter, alarm silence and reset pushbuttons, horn, and flasher. The panel shall include a NEMA-rated motor starter with overloads, reset. All wiring shall be copper, 600 volts rated, identified at each end. Provide dry contacts for all status and alarm signals for remote monitoring. The panel shall be UL listed with a 14k SCCR rating.

2.09 RE-AERATION BASINS

A. Each Re-Aeration Zone shall be provided with a coarse-bubble diffused-aeration system to aerate the tank contents.

B. The coarse-bubble air diffusers shall be a non-clog, multi-leaf spring design, each with a capacity of not less than 30 CFM. The diffuser shall be fabricated of Type 304 stainless steel with 0.20 inch minimum wall thickness.

C. Each coarse-bubble diffuser shall have three stainless steel leaf springs fastened to the body with 3/16-inch stainless steel blind rivets and each covering four 7/8-inch-diameter air discharge ports. The spring shall act as a check valve to eliminate plugging. The leaf spring deflects only slightly, oscillating at a high frequency, shearing the air as it is released to provide optimum bubble size and high oxygen transfer. The springs automatically produce a controlled backpressure to ensure uniform air discharge through the entire diffuser network without the use of air restrictors, balancing inserts, or orifices in the header system.

D. The Re-Aeration Zone coarse bubble aeration system shall be designed based on an airflow rate of 10 cfm/1,000 cf of tank volume.

2.10 SECONDARY CLARIFIER

A. The clarifier shall be designed to meet the requirements set forth in the Design Requirements section of these Specifications. The clarifier shall consist of a clarifier influent assembly, sludge collector mechanism, effluent launderer, scum baffle, stilling well, and scum removal system.

B. The clarifier influent line shall be fabricated from 12-inch-diameter steel pipe and shall be designed to prevent liquid backup in the process tanks during peak flows and to prevent settling out of solids that may clog the pipe. The clarifier influent collection point shall be near the bottom of the aeration tank at a point farthest in flow from the raw sewage injection point. From the collection point, the pipe shall run at an angle toward the center of the clarifier, vertically upward into the stilling well, and the liquid shall discharge out into the clarifier through the pipe opening.

C. The sludge collector mechanism shall be a center collection type to facilitate the rapid return of sludge from the clarifier back to the aeration system. The unit shall consist of all mechanical equipment required for operation including complete drive unit, drive shaft, sludge scraper arms, return sludge pipe, and collection sump.

D. The mechanism shall be centered with the clarifier and shall be supported by the bridge structure. No part of the drive unit shall extend through the walkway. Access to the drive mechanism shall be by an aluminum checkered plate lift-up cover provided on the walkway.

E. A 4-inch-diameter steel pipe shaft shall extend to the bottom of the clarifier, at which point it shall be pivoted in such manner as not to introduce binding.

F. The drive mechanism shall be designed to provide a torque capable of overcoming running friction and loads induced by scraping sludge to the collection point at a speed to prevent sludge agitation.

G. The drive mechanism shall consist of a double reduction worm gear reducer. Housings shall be a one-piece casting made from close grained gray iron designed to provide constant lubrication and adequate heat dissipation. Worm gears shall be forged bronze providing a dense grain structure. Speed-reducer worms shall be made from alloy steel and shall be integral with the input shaft providing increased strength, accuracy, and efficiency. The threads shall be milled, case-hardened, and ground. The shaft shall be ground and polished. All output shafts shall be stress-relieved medium carbon steel. The entire shaft shall be ground and the area in contact with the oil seal shall be polished. All bearings on the output shafts shall be tapered roller bearings. The input shaft shall have double-row ball bearings.

H. A 1/2 HP, 230/460-Volt, three-phase, 60Cycle, 1,800 RPM motor shall power the reducer. Motor shall be TEFC, 56C frame with Class B insulation.

I. A sprocket shall be mounted on the driveshaft of the reducer driving a larger sprocket mounted on the scraper mechanism shaft extension. The sprockets shall be sized to provide a scraper tip speed of approximately 10 feet per minute and shall be coupled by a roller chain. Slots shall be provided for mounting the reducer to allow for adjustment of chain slack without removing links. A spring-loaded idler sprocket shall be provided to maintain chain tension.

J. The scraper mechanism sprocket shall be equipped with an overload protection device consisting of a shear pin and shear pin hub, assembled in such a manner that it will disengage the sprocket from the clarifier shaft once the shear pin rated torque is reached. The primary reduction unit shall be electrically interlocked so

that after disengagement of the sprocket from the clarifier shaft the primary unit motor will be shut down and alarm contacts actuated. The shear pin torque rating shall not exceed design torque of the collector mechanism structural components nor shall such torque, when reflected through reduction sprockets to the slow speed shaft of the primary unit, exceed its rating.

K. The clarifier shall be provided with two rotating scraper arms. The rotating scraper arms shall be attached to and supported by a center shaft designed to support and rotate the scraper arms under maximum load conditions with an adequate factor of safety. The scraper arms shall be fabricated from 1/4-inch-thick structural steel members to provide support for scraper blades. Nylon reinforced, 1/4-inch PVC blades shall be provided on the rotating arms to move settled sludge to the center collection point. The blades shall be spaced on each arm so that settled sludge is collected over the full area of the basin by each arm. The scraper arm outer ends shall be adjustable in a radial direction. At final adjustment, blades shall clear the floor by 1/4-inch.

L. The sludge shall be moved toward the center of the clarifier by means of scraper blades at the rate of two blade separation distances per revolution. Sludge shall be collected in the clarifier center sump and removed from the sump by means of a 4-inch- diameter steel sludge draw-off pipe. The sludge draw-off pipe shall be extended to the outer wall and used as the clarifier drain line.

M. A steel mitered clarifier effluent launderer shall be provided around the inside periphery of the clarifier to collect the clear supernatant. The launderer shall be designed to carry the expected peak flow without becoming submerged.

N. Aluminum serrated weir plates shall be attached to each side of the launderer and shall be vertically adjustable for leveling. Each weir plate shall be fabricated from 1/8-inch-thick aluminum with 1-1/4-inch-deep 90-degree V-notches on 2-1/2-inch centers. Gasketing material 1/4 inches thick x 4 inches wide shall be attached to the back of the weir plates to prevent leaks.

O. A 23-inch-wide-x-1/4-inch-thick steel scum baffle shall be provided to prevent floating scum from being carried over the weir. The scum baffle shall project 17 inches below and 6 inches above the clarifier water surface and shall be attached to the brackets that support the launderer.

P. The scum removal system shall consist of a 6-inch-wide-x-6-inch-deep-x-1/8-inch-thick steel scum collection trough, a steel surface skimmer arm, a Schedule 40 steel scum discharge airlift and a 1/8-inch-thick Type 304 stainless steel scum strainer box. The scum collection trough shall be designed to collect the floating material on the surface of the clarifier and shall be accessible from the bridge. The scum trough shall be structurally supported off the scum baffle and

clarifier influent pipe and shall be vertically adjustable on both ends without draining the clarifier tank. Removal of the scum from the collection trough shall be by a Schedule 40 steel airlift pump. The pumping shall be intermittent, pumping only when the skimmer arm is in the area of the collection trough. Intermittent pumping shall be controlled by a limit switch and timer electrically interlocked to a solenoid valve on the scum airlift air supply line.

Q. The scum collection trough shall extend the full width of the clarifier, from the scum baffle at the outside, to the stilling well on the inside, thereby eliminating any possibility of scum escaping the system.

R. The skimmer arm shall be designed to skim the entire surface of the clarifier twice during one rotation of the scraper mechanism and scrape the scum into the scum collection trough. The arm shall be supported off the stilling well and shall not rely on any support from the scum baffle or wall.

S. A 48-inch-deep-x-3/16-inch-thick steel stilling well shall be provided for velocity dissipation for the mixed liquor suspended solids (MLSS) entering the clarifier and to prevent short circuiting from the center to the weir. A scum escape port shall be provided in the side of the stilling well at the water surface. The stilling well shall be fixed to the rotating center shaft.

T. Each clarifier shall include a local control panel. The panel shall be NEMA 4X rated, 316 stainless steel suitable for a 480-volt incoming power supply. The panel shall include a flange type disconnecting means with a main breaker, CPT, running and alarm LED indicators, drive on/off selector switch, scum solenoid HOA, timer, elapsed time meter, alarm silence and reset pushbuttons, horn, and flasher. The panel shall include a NEMA rated motor starter with overloads, reset. All wiring shall be strained copper, 600 volts rated, identified at each end. Provide dry contacts for all status and alarm signals for remote monitoring. The panel shall be UL listed with a 14k SCCR rating.

2.11 RAS AND WAS

A. The RAS system shall consist of a Type 304 stainless steel measuring box and a 6-inch-diameter, steel return sludge airlift pump assembly to allow a range of RAS flows from 50% to 150% of design influent Q. The bottom of the return sludge airlift pump shall be connected into the return sludge draw-off pipe.

B. The return sludge measuring box shall be fixed to the top of the return sludge airlift. The box shall be fabricated from 3/16-inch minimum thickness, Type 304 stainless steel plate. The box shall be adequately covered and baffled to prevent splashing of the sludge.

C. A weir shall be provided on the box discharge opening to provide an indication of the amount of flow discharged from the box. A weir calibration chart shall be provided in the operations manual so that the flow can be estimated by manually measuring the sludge level in the box and comparing to the chart.

D. The WAS system shall consist of a Type 304 stainless steel measuring box and a 4-inch-diameter, steel waste sludge airlift pump assembly. The bottom of the waste sludge airlift pump shall be connected into the waste sludge draw-off pipe.

E. The waste sludge measuring box shall be fixed to the top of the waste sludge airlift. The box shall be fabricated from 3/16-inch minimum thickness, Type 304 stainless steel plate. The box shall be adequately covered and baffled to prevent splashing of the sludge.

F. A weir shall be provided on the box discharge opening to provide an indication of the amount of flow discharged from the box. A weir calibration chart shall be provided in the operations manual so that the flow can be estimated by manually measuring the sludge level in the box and comparing to the chart.

2.12 ACCESS, BRIDGE, AND WALKWAYS

A. The main access bridge shall be made of structural steel shapes of 1/4-inch minimum thickness and shall be supported on the top of the plant walls along with any additional support columns required. The bridge shall be designed to also support the two Rotary Drum Screens and Discharge Conveyor (provided by others). The bridge shall extend across the tanks as shown on the Drawings. The bridge beams shall be fabricated from steel rectangular tubing and be used as air transfer headers for the plant air supply distribution system. An 8-inch flanged plant air header connection shall be provided under the entrance end of the bridge as shown on the Drawings.

B. The bridge shall have a 36-inch-wide deck made of 1-inch aluminum I-Bar grating and shall be designed to withstand a uniform live load of 75 pounds per square foot plus the dead load of the structure. The deflection shall not exceed 1/360 of the unsupported span when the design loads are applied. The bridge shall be provided with handrails on both sides consisting of two-rail 1-1/2-inch-diameter Schedule 40, anodized aluminum pipe with Schedule 80 handrail posts and 4-inch-x-1/4-inch anodized aluminum toeplate. Bridges having an unsupported section larger than 37 feet shall have a steel truss handrail design with the top chord serving as the top handrail and diagonals serving as intermediate rails. The truss handrails shall be fabricated from square steel tubing of sufficient size. The bridge deck shall include necessary brackets for pole mounted lighting fixture mounting to comply with local wind loading codes.

C. Access to the plant bridge shall be provided by a 36-inch-wide stairway with intermediate landing as shown on the Drawings. The stairway shall be provided with handrails on both sides consisting of two-rail 1-1/2-inch-diameter Schedule 40 anodized aluminum pipe with Schedule 80 handrail posts. The steps shall be installed on a 7-inch maximum rise with an 11-inch run and shall consist of 1-1/2-inch aluminum I-Bar grating stair treads with nosing. The intermediate landing shall have a deck made of 1-inch aluminum I-Bar grating and shall be designed to withstand a uniform live load of 75 pounds per square foot.

D. Walkways shall be provided for access to and maintenance of the clarifier weir and all air diffuser drop pipes and regulating valves. Additional walkways shall be provided in locations as shown on the Drawings or as needed to service the equipment.

E. Access and maintenance walkways shall be a minimum of 24 inches wide and have a deck made of 1-1/2-inch aluminum I-Bar grating adequately supported to withstand a live load of 75 pounds. per square foot. All walkways shall be provided with handrails on both sides consisting of two-rail 1-1/2-inch-diameter Schedule 40 anodized aluminum pipe with Schedule 80 handrail posts and a 4-inch-x-1/4-inch anodized aluminum toeplate.

2.13 FASTENERS

A. All fasteners shall be Type 316 stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the equipment in the locations as shown on the Drawings and in accordance with the manufacturer's instructions and recommendations and the approved shop drawings.

3.02 PAINTING AND SURFACE PREPARATION

A. Shop Preparation

1. All steel surfaces, except for the wall plates and trim channels for the inner and outer walls, shall receive a near white blast to remove rust, mill scale, and weld slag. Plant inner and outer wall plates and trim channels shall be shipped black steel. All weld splatter and surface roughness shall be removed by chipping and grinding smooth. Blasting shall be accomplished indoors using steel shot to produce a mil profile for optimum adhesion of

the primer. Sand blasting at the factory shall not be acceptable. Blasting outdoors at the factory shall not be acceptable.

2. All blasted surfaces shall be thoroughly dry and free from preparation dust and foreign matter before the application of any coating. Painters applying protective coatings shall be thoroughly familiar with the application guidelines and preparation requirements of the product to be applied. All materials shall be evenly applied and shall be free from obvious defects.
3. Protective coatings shall not be applied to improperly prepared surfaces or during conditions considered to be not conducive to sound painting practices or in fog, rain, snow, mist, when the surface temperature is less than 40°F, and/or the humidity exceeds 85%.
4. Immediately after surface preparation, a rust inhibitive epoxy primer coat shall be applied. No discoloration of the cleaned areas shall occur before the application of the prime coat. All steel surfaces shall receive a 3-mil dry film thickness of Sherwin-Williams B62Y110 Copoxy primer or engineer-approved equal.

B. Field Preparation

1. The wall plates and trim channels for the inner and outer tank walls, and all field welds and marred areas shall be near-white blasted to remove weld slag and surface impurities.
2. Immediately after surface preparation, a rust inhibitive epoxy primer coat shall be applied to all newly blasted surfaces. No discoloration of the cleaned areas shall occur before the application of the prime coat. All newly blasted steel surfaces shall receive a 3-mil dry film thickness of Sherwin-Williams B62Y110 Copoxy primer.
3. After the newly primed areas are dry and ready for a topcoat, all exterior surfaces shall be coated with a 6-mil minimum dry film thickness topcoat of Sherwin-Williams Dura-Plate 235 multi-purpose epoxy. The color shall be as selected by the engineer/owner.
4. After the newly primed areas are dry and ready for a topcoat, all interior surfaces shall be coated with a 6-mil minimum dry film thickness topcoat of Sherwin-Williams Dura-Plate 235 multi-purpose epoxy. The color shall be as selected by the Engineer/Owner.
5. Dry film thickness of all coats shall be measured by employing standard calibrated dry film thickness gauges.

3.03 START-UP

A. Before initial start-up and filling of the treatment unit with liquid but after the treatment unit has been installed with all necessary influent, effluent, and other yard piping, and electrical connections have been completed, the manufacturer shall inspect the installation in the presence of the Engineer and provide written

certification that the treatment unit and all associated equipment are installed in accordance with the manufacturer's instructions and the treatment unit is ready for initial start-up.

B. Leakage Testing: The method used to initially fill the treatment unit with liquid may be selected by the Engineer to test the hydrostatic design. Any equipment failure, excessive structural deflection, and/or leakage of any kind shall be remedied, and all costs shall be borne by the treatment unit manufacturer.

1. Before initial start-up and after the treatment unit tankage has been painted and properly cured and upon approval of the Engineer to begin, the treatment unit manufacturer, assisted by the Contractor, shall perform leakage testing to demonstrate provision of a watertight and rigid structure as specified in this Section to the satisfaction of the Owner.
2. All water-holding tanks shall be subjected to leakage tests using clean water provided by the Contractor. The method used to initially fill the treatment units with water shall be approved by the Engineer for leakage testing and to test the hydrostatic design. Any failure or excessive deflection shall be remedied, and all costs shall be borne by the manufacturer.
3. All water-holding tank structures and zones shall be individually filled and tested with water to the maximum liquid level shown on the Drawings before leakage testing. All valves and gates to the structure shall be closed and the change in water surface measured for 24 hours. Interior hydrostatic zone partition walls shall be tested with one side of the wall loaded by maximum water level loading and the opposite side of the wall in a dry or drained state (no water load).
4. During the leakage testing period, all exposed portions of the structure shall be examined for dampness or leakage and all visible leakage or damp spots shall be marked; such leakage or damp spots shall be later patched or corrected in a manner acceptable to the Engineer before additional leakage testing. If the drop in water surface elevation in the 24-hour period exceeds 0.1% of the normal volume of liquid contained in the water-holding structure after accounting for evaporation and precipitation in open basins or if damp spots or any seepage is present on the walls or other areas exposed to view, the leakage shall be considered excessive, and the leakage testing will be considered to have failed. Evaporation water loss and precipitation water addition shall be determined by floating a pan in the structure during the testing period.
5. If the leakage testing is failed, the water-holding structure shall be drained, all leakage and damp spots previously marked shall be patched, the necessary repairs made, and the tankage shall be retested. The Contractor's and/or manufacturer's method of repair shall conform to the requirements of this Section and be submitted for review by the Engineer. Following

repair, the water-holding structure shall then be refilled and retested for leakage. The leakage testing and repair process shall be repeated as many times as necessary until the leakage testing passes. All repairs of faulty workmanship and materials and any additional tests shall be made by the Contractor and manufacturer in an acceptable manner and at no additional cost to the Owner.

6. The purpose of the leakage testing is to determine the integrity of the finished tank. Therefore, all other equipment, i.e., stop gates and valves or temporary bulkheads should be made watertight before the testing.
7. As an alternative to having watertight bulkheads, stop gates, or valves, the Contractor shall accurately measure the leakage through stop gates, valves, and bulkheads with methods acceptable to the Engineer. An "assumed" leakage through gates and valves based on their manufacturer's recommendations is not acceptable.

C. Secondary Clarifier Mechanism Testing: The factory-authorized service representative shall perform the testing described in this Section under the onsite supervision of the Engineer. All power, water, equipment, and appurtenances required for testing shall be furnished by the Contractor.

1. With the clarifier basin completely dewatered, the factory-authorized service representative shall perform torque testing for each clarifier mechanism to verify the structural integrity and conform proper operation of the overload torque alarm and motor shutdown circuitry.
2. The torque test shall be accomplished by anchoring one arm and applying load by means of a hydraulic cylinder with the mechanism’s operation. Complete test procedures shall be submitted for approval by Engineer before testing.
3. Upon completion of the static and operating torque tests, the mechanism shall be run dry for 8 hours and shall operate without vibration, noise, jamming, or overheating. During the dry test run of the equipment, special attention shall be given to the operation of the scum-removal device. The settings of the scum skimmer arms shall be such as to ensure that an adequate volume of scum and effluent will be discharged once every complete revolution of the sludge mechanism under normal operating conditions.
4. If the mechanisms fail to meet the above test, the necessary changes shall be made, and the mechanisms retested. If the mechanisms remain unable to meet the test requirements to the satisfaction of the Engineer, they shall be removed and replaced with satisfactory mechanisms at no expense to the Owner.
5. The Contractor shall grout the clarifier in presence of the manufacturer’s representative.

6. The factory-authorized service representative shall verify that each drive assembly, drive cage, and scraper arms are operating in accordance with the requirements of the Contract Documents and the manufacturer's recommendations. Adjust the output torque of the drive assembly as needed for compliance with the manufacturer's recommendations and the Contract Documents.
7. During the final mechanical performance test, the Contractor shall adjust and level the clarifier launder weir plates as directed by the Engineer if the Engineer or Owner observes uneven secondary effluent flow collection around the clarifier basin periphery.

D. Submersible Mixer Testing: All the tests specified in this Section shall be performed under the onsite supervision of the Engineer.

1. Pre-Startup Testing: The Contractor shall perform the pre-startup testing before the startup testing. The pre-startup testing services shall be performed while the anoxic basins are completely dewatered.

    a. Visually inspect each submerged mixer drive assembly and certify that the submersible mixers and hoist assemblies have been furnished in accordance with this Section.
    b. Visually inspect and verify that the incoming electrical service has been installed in accordance with the manufacturer's recommendations.
    c. Verify that each Mixer Control Panel has been furnished with all of the controls and alarms specified in this Section and have been installed in accordance with the manufacturer's recommendations.
    d. Verify the HIGH TEMPERATURE settings for the submersible mixers are correct and adjust them in accordance with the manufacturer's recommendations as needed.

2. Startup Testing: The factory-authorized service representative shall perform the startup testing. The startup testing services shall be performed while all anoxic basins are filled with clean water provided by the Contractor to the maximum water surface elevation shown on the Drawings. Each submersible mixer shall be run at full speed and full load for a minimum of 24 hours. If the mixer fails to meet the performance requirements specified in Contract Documents, the necessary changes shall be made, and the mixer retested. If the mixer remains unable to meet the test requirements to the satisfaction of the Engineer, they shall be removed and replaced with satisfactory mixer at no expense to the Owner.

E. Treatment Units Start-up: The Contractor shall seed the anoxic and aeration zones with 30,000 gallons of RAS/WAS not less than 10,000 mg/L in solids concentration in solid from a nearby domestic wastewater treatment plant. In

addition, the Contractor will provide VitaSim Dynamic Duo as manufactured by Aquafix, Inc. and dose at the manufactured recommended range to accelerate the growth of nitrifying bacteria. The Contractor shall also assist the Owner and Engineer with the start-up. The Contractor shall secure samples from the treatment unit compartments as requested by the Engineer. The Contractor shall adjust equipment settings and flows as required by the Engineer during start-up to optimize the treatment unit operation.

3.04 TRAINING SERVICES

A. A factory-authorized service representative shall be onsite to perform training services. The manufacturer's representative performing this service shall be a direct employee of the equipment manufacturer and normally engaged in this type of service work.

B. The manufacturer shall provide the training services on site for a minimum of 5 days excluding any travel time. When leakage testing is successfully completed and initial start-up demonstrates plant operation meeting required effluent requirements under initial flows and loads, the manufacturer shall provide the services of a factory-trained representative to instruct the Owner's operating personnel in operating and maintaining the equipment. The manufacturer or his representative shall perform any necessary adjustments for satisfactory operation.

C. The training shall include detailed instruction on installing the spare clarifier drive unit. This training is required to ensure that County personnel can replace this equipment if the need arises. Instructions shall also be provided on the proper storage and maintenance of the stored drive. The manufacturer/supplier shall issue a certification of training concerning the clarifier training and the treatment unit training. The certification shall state that the Owner’s personnel has received this training and is competent to operate, maintain, and install the clarifier drive as well as to maintain and operate the treatment unit.

3.05 MANUFACTURER’S CERTIFICATION OF COMPLIANCE

A. The equipment manufacturer shall provide a written report covering findings and installation approval. The report shall describe all inspections and any deficiencies noted and shall be mailed directly to the Engineer. The report shall certify that the equipment has been properly installed, tested, inspected, and is ready for startup and placed into permanent service.

END OF SECTION

SECTION 11535
SUBMERSIBLE NON-CLOG CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, new materials, equipment, and incidentals necessary for the complete installation of the submersible non-clog centrifugal pumps at the Influent Pumping Station, Plant Drain Pumping Station, Reject Pump Station, if applicable, including but not limited to pumps, pump bases, guide rail, and lifting system as shown on the Drawings and specified in this Section.

B. The pumps, motors, control panels, guide rails, and access cover shall be furnished by a single supplier. The pump supplier shall be responsible for overall supply and quality of these items and shall be responsible for testing, start-up, troubleshooting, and personnel training for the submersible non-clog centrifugal pumps and lift stations.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The Contractor shall submit written certification from the pump supplier that the wet well or tank size and layout are acceptable for the pump installation.

B. Shop Drawings: The Contractor shall submit integrated shop drawings for the pumping system illustrating the mechanical and electrical equipment and components specified in this Section and including the following:

1. Product Data: For each mechanical, structural, and electrical component include the manufacturer’s descriptive literature, product specifications, published details, technical bulletins, performance, and capacity-rating curves with primary and secondary design conditions clearly noted, charts, and schedules, catalog data sheets, and other submittal materials as required to verify that the proposed products conform to the quality and function of the specified products.

a. Identification: Clearly indicate by an arrow on submissions covering more than one product type or style exactly which product is being submitted for approval.

b. Equipment Characteristics: Provide bearing ratings, complete motor data, service factors, shaft diameters, coupling type, and weights of principal parts and assembled equipment.

c. Manufacturer: Include the catalog name, company name, address, and telephone number for the manufacturer of each product submitted.

2. Equipment Drawings: Submit completely dimensioned plan, elevations, and cross-sections of system equipment and sub-assemblies.

3. Layout Drawings: Submit completely dimensioned drawing of pump, pump base, anchor bolt size and patterns, complete guide rails system, installation notes, recommended grout configuration of wetwell or tank bottom, discharge elbow mounting instructions, and other pertinent setting details.

4. Product List: Provide a list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.

5. Wiring Diagrams: Submit complete interconnecting wiring diagrams and schedules for electrical apparatus showing numbered wiring terminals in the pump control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.

6. Control Panel Drawing: Submit a dimensioned drawing of the control panel indicating the primary electrical components and panel face with control devices, lights, indicators, and other panel-face-mounted apparatus located and identified. Provide an internal face view of the equipment arrangement with equipment identified.

7. Additional Requirements: See Division 13, Special Construction, for additional submittal requirements for the control panel furnished under this Section and specified below.

C. Pump Test Report: Submit certified copies of factory-run pump performance test curves. Factory-certified performance test curves shall indicate the following:

1. Flow in gallons per minute.

2. Total head in feet of water.

3. Horsepower.

4. Pump efficiency in percent of input shaft horsepower.

5. Pump data:

    a. Model number.
    b. Serial number.
    c. Impeller diameter and type.
    d. Impeller speed.

6. Test condition data:

    a. Date of test.
    b. Mean water temperature.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 318/318R—Building Code Requirements for Structural Concrete.

B. American Iron and Steel Institute (AISI)

C. American National Standards Institute/Hydraulic Institute (ANSI/HI)

1. ANSI/HI 1.1-1.2—Rotodynamic (Centrifugal) Pumps for Nomenclature and Definitions.
2. ANSI/HI 1.4—Rotodynamic (Centrifugal) Pumps for Manuals Describing Installation, Operation, and Maintenance.

D. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
3. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
4. ASTM A123/A123M—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

5. ASTM C478—Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.

E. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.

F. American Waterworks Association (AWWA)

1. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).

G. International Standards Organization (ISO)

1. ISO 2858—End Suction Centrifugal Pump (Rating 16-Bar) Designation, Nominal Duty Point and Dimensions.
2. ISO 5199—Technical Specifications for Centrifugal Pumps, Class II.
3. ISO 7005-2—Metallic Flanges – Part 2: Cast Iron Flanges.

H. National Electrical Manufacturer's Association (NEMA)

1. NEMA 250—Enclosures for Electric Equipment (1,000 Volts Maximum).
2. NEMA 3R—Rain-Proof and Sleet- (Ice-) Resistant-Outdoor Enclosures.
3. NEMA Design B—Electrical Induction Motors.
4. NEMA ICS-1—Industrial Control and Systems: General Requirements.

I. National Fire Protection Association (NFPA)

1. NFPA 70—National Electrical Code.

J. Underwriters Laboratory (UL)

1. UL 508—Standard for Industrial Control Equipment.

1.04 QUALITY ASSURANCE

A. The pumps shall be shipped to the jobsite complete with the motor, local wiring, control, equipment base, and anchor bolts and other appurtenances as specified pre-installed. Control Panel and spare parts shall be shipped loose and ready for installation at the location shown on the Drawings.

B. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the mechanical, electrical,

and material integrity established by these Specifications shall be identified by the Contractor and submitted to the Engineer for review.

1.05 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified shall meet the following requirements:

1. Shall have been in business for at least the 10 years before the Bid Date.
2. Shall have a record of operating, manufacturing, and servicing the types of items specified for a minimum of 10 years before the Bid Date.
3. Shall have a minimum of five installations of equipment similar to and meeting the requirements specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.

1.06 SYSTEM DESCRIPTION

A. The pump station(s) shall have submersible centrifugal non-clog pumps as specified in this Section with controls capable of operating the pumps either individually, alternately, and/or simultaneously, depending on the load condition.

B. The pump station(s) shall be complete units with necessary appurtenances installed within the pump intake basin (wet well or tank).

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

O&M manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals, and shall include the following:

A. Installation instructions.

B. Functional description of the pumping control system for each mode of operation of equipment.

C. Automatic and manual operation.

D. Alarms and fail-safe features.

E. Interlocked and/or interfaced equipment operation and control.

F. Exploded view drawings and illustrations with descriptions for assembly and disassembly of equipment.

G. Comprehensive parts and materials maintenance and repair list for each equipment element indicating the manufacturer and the manufacturer's identification number. Include the name, address, and telephone number of local sales and service office for major equipment items.

H. Schedules of recommended spare parts to be stocked, including part number, inventory quantity, and ordering information.

I. Performance rating and nameplate data for each major system component.

J. Procedures for starting, operating, adjusting, calibrating, testing, and shutting down system equipment.

K. Emergency operating instructions and trouble-shooting guide.

L. Schedule of routine maintenance requirements and procedures and preventative maintenance instructions required to ensure satisfactory performance and equipment longevity.

M. Maintenance instructions for extended out-of-service periods.

N. Schedule of lubrication requirements, including lubricant type, service interval, and lubrication points.

O. Field-verified power and control wiring schematics. Submit the approved schematics in each manual. After initial start-up and operation, correct these schematics to reflect any required field changes and submit the required copies for inclusion in the manuals.

P. Electronic copies of the O&M manuals shall be submitted before the equipment arrives at the site. The Contractor shall not be compensated for the pumping equipment until the preliminary O&M manuals are received. Electronic copies of the final O&M Manuals shall incorporate the Engineer’s comments and be submitted with copies of the approved shop drawings and test reports. The Owner may request additional physical copies of the O&M manuals as part of this Contract.

Q. Installation Certificate: Submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each pump furnished and installed and specified in this Section stating that the equipment has been installed, inspected, and adjusted as required in accordance with the manufacturer’s written installation procedures and operating instructions and is ready for acceptance by the Owner.

1.08 SPARE PARTS

A. The following list of spare parts shall be included for each pump:

1. One set of bearings.
2. One seal.
3. One gasket.
4. One O-ring.

1.09 SPECIAL CONSIDERATIONS

A. All of the equipment, accessories, and controls specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

PART 2 PRODUCTS

Materials and equipment shall conform to the referenced publications or as specified and indicated and shall be the products of manufacturers regularly engaged in the manufacture of such products.

2.01 SUBMERSIBLE CENTRIFUGAL NON-CLOG PUMPS

A. Equipment Identification Labels

1. Influent Pumping Station:

a. Influent Pump Station Pump 1
b. Influent Pump Station Pump 2
c. Influent Pump Station Pump 3 (Future)

2. Plant Drain Pumping Station:

a. Plant Drain Pump Station Pump 1
b. Plant Drain Pump Station Pump 2
c. Plant Drain Pump Station Pump 3 (Future)

3. Reject Pumping Station:

a. Reject Pump Station Pump 1
b. Reject Pump Station Pump 2

B. Major pump components shall be of grey cast iron ASTM A48/A48M Class 35B or 40B for air-filled pumps and ASTM A48/A48M Class 30 for oil-filled pumps, with smooth well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. All exposed nuts or bolts shall be Type 300 series stainless steel. The discharge nozzle shall be flanged and sufficiently rigid to support the guiderail-mounted pumping unit under all operating conditions.

C. For Enclosed Impeller: The impeller shall be an enclosed one-piece casting, ASTM A48/A48M Class 35B or 40B for air-filled pumps and ASTM A48/A48M Class 30 for oil-filled pumps, cast iron, with not more than two non-clog passages. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity.

D. For Vortex Impeller: The impeller shall be vortex type ASTM A48/A48M Class 35B or 40B for air-filled pumps and ASTM A48/A48M Class 30 for oil-filled pumps, cast iron, free from cracks and porosity. Vortex impellers may be Hard-Iron ASTM A532 with semi-open, multi-vane, back swept, screw-shaped, non-clog design and leading edges of the impeller hardened to Rc 60 and capable of handling solids.

E. The impeller shall be dynamically balanced and securely locked to the shaft by a key and self-locking bolt or nut.

F. Coatings: All metal surfaces in contact with the pumped media, other than stainless steel, shall be coated in the factory with a zinc primer and polyester resin or high-solids epoxy finish.

G. Wearing Rings for Enclosed Impellers: Renewable Type 316 stainless steel wearing rings shall be provided in the casing and on the impeller. The rings shall be positively locked in place.

H. Oil Chamber Housing: The oil chamber shall contain a drain plug and a vent plug.

I. Air-Filled Pump Seals

1. Each pump shall be provided with two mechanical rotating shaft seals arranged in tandem and running in an oil chamber. The lower seal unit between the pump and the oil chamber shall contain one stationary and one positively driven rotating tungsten carbide ring. The upper seal unit between the oil chamber and the stator housing shall contain one stationary tungsten carbide ring and one positively driven rotating carbon ring. Each interface shall be held in contact by an independent spring system designed to withstand maximum suction submergence. The seals

shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement.

2. Shaft seals lacking positively driven rotating members or conventional double mechanical seals which use a common single or double spring acting between the upper and lower units and requiring a pressure differential to offset external pressure and effect sealing will not be acceptable. The seals shall not rely upon the pumped media for lubrication and shall not be damaged if the pumps are run unsubmerged for extended periods while pumping under load.

J. Oil-Filled Pump Seals: Each pump shall be provided with two mechanical rotating shaft seals arranged in tandem and with an oil chamber between the seals. John Crane Type 21 seals shall be used with the rotating face of the seal shall be carbon and the stationary seal faces shall be ceramic. The pump shall be equipped with 300 Series stainless-steel hardware and a 300 Series stainless-steel shaft sleeve for under the lower seal. A seal leak detection sensor shall be provided between the seals.Sealing of Mating Surfaces: All mating surfaces of major components shall be machined and fitted with O-rings where watertight sealing is required. Sealing shall be accomplished by O-ring contact on four surfaces and O-ring compression in two planes, without reliance on a specific fastener torque or tension to obtain a watertight joint. The use of elliptical O-rings, gaskets, or seals requiring a specific fastener torque value to obtain and maintain compression and watertightness will not be acceptable. The use of secondary sealing compounds, gasket cement, grease, or other devices to obtain watertight joints will not be acceptable.

K. Discharge Base

1. The manufacturer shall furnish a pump base mounting plate and pump base elbow for each pumping unit. The base shall be sufficiently rigid to firmly support the guiderails, discharge piping, and pumping unit under all operating conditions. The base shall be provided with one or more integral support legs or pads suitable for bolting to the floor of the pump intake basin. The face of the discharge elbow inlet flange shall be perpendicular to the floor and shall make contact with the face of the pump discharge nozzle flange. The diameter and drilling of the elbow outlet flange shall conform to ASME B16.1 Class 125.
2. The pump and motor assembly shall be automatically connected to and supported by the discharge base and guiderails so that the unit can be removed from the wet well or tank and replaced without the need for operating personnel to enter the pump intake basin.

L. Pump Characteristics

Unit designation*	Influent Pump Station	Plant Drain Pump Station	Reject Pump Station
Number of Units	2 (1 Future)	2 (1 Future)	2
Total Head at Primary Design Condition (feet)	54	51	21
Capacity at Primary Design Condition (gpm/ea.)	1700	400	450
Minimum Efficiency at Primary Design Condition	70	57	55
Shut-off Head Minimum (feet)	82	78	25.5
Rated Pump Speed (rpm)	1200	1800	1800
Motor Power (hp)	45	10	5
Discharge Elbow Outlet Diameter (inches)	8	4	4
Minimum Discharge Sphere Diameter (inches)	3	3	3
Minimum Hydrostatic Test Pressure	1.5 times shutoff head plus suction pressure		

*BNR Package Plant Submersible Pumps shall be as required by awarded manufacturer. Contractor shall be responsible for coordinating any additional Pumps with Engineer.

1. Pump performance shall be stable and free from cavitation and noise through the specified operating head range at minimum suction submergences.

2. Each pumping unit shall be designed so that reverse rotation at rated head will not cause damage to any component.

M. Acceptable Pump Manufacturer/Model

1. Influent Pump Station:

   a. Flygt Model: NP 3202 MT 3~ 642
   b. Engineer-Approved equal.

2. Plant Drain Pump Station:

   a. Flygt Model: NP 3127 HT 3~ Adaptive 488
   b. Engineer-Approved equal.

3. Reject Pump Station:

   a. Flygt Model: NP 3102 MT 3~ Adaptive 464
   b. Engineer-Approved equal.

N. Cable Entry: Cable entry consists of a compressible rubber bushing to seal off motor area and relieve strain on the cable. Cable entry housing is constructed of vinylester for shock and chemical resistance.

O. Junction Box: Box is sealed off from surrounding liquid and stator casing via terminal board and an O-ring.

P. Motor: Squirrel cage, 3 phase induction shell type design NEMA B motors are specifically designed for each mixer frame size. Non-overloading for full performance range. Motor insulation is Class F with a maximum working temperature of 155°C (311°F). Combined service factor of 1.10. Motors can be run continuously or intermittently. The stator is cooled by the surrounding mixed media.

Q. Oil Casing: An environmentally friendly white paraffin based, FDA approved, non-toxic oil lubricates and cools the seals and acts as an additional barrier to prevent liquid from penetrating the motor area. Pressure build-up within the casing is reduced by an inner and outer oil compartment design which transports any foreign liquids away from rotating components. Casing is constructed of vinylester for shock and chemical resistance.

R. Bearings: Bearings are rated in excess of 100,000 hours of operation (L-10aa rated life). Shaft is supported by a single row angular contact ball bearing and single row cylindrical roller bearing, plus a heavy duty single row angular contact ball bearing on the propeller side.

S. Shaft: Motor shaft and rotor are a single integral unit. Shaft is completely isolated and cannot come in contact with the mixed media.

T. Active Shaft Seals: Outer mechanical seal isolates the oil housing and surrounding liquids and is tungsten carbide lapped end faced running in oil. Inner mechanical seal operates between oil casing and stator casing. Only seal faces operate in the mixed media, all other components are within motor housing. One seal face of the inner seal pair has laser etched spiral grooves. As the seal rotates, these grooves act to pump any leakage back into the oil casing from out of the stator housing.

U. Propeller: Two bladed, 316 stainless steel propeller. Blades have large width, thin profile and smooth surface with a back swept design for optimum efficiency and non-clogging operation. The blades are laser cut to exacting tolerances. Propeller is available in other materials - consult Flygt.

V. Monitoring Equipment: The stator incorporates three thermal switches connected in series (one in each phase) which open at 260°F (125°C).

2.02 ELECTRIC MOTORS

A. Air-Cooled Motors: Each pump shall be driven by an air-filled, totally submersible electric motor manufactured by the pump manufacturer. Each motor shall be rated 460 volts, 60 Hz, three-phase and shall have a service factor of 1.15. The motor nameplate rating shall exceed the maximum horsepower required by the pump in the operating head of the entire pump curve. The motor shall operate over the entire range of the pump curve without overloading the motor or operating in the service factor of the motor. The stator housing shall be an air-filled, watertight casing. Motor insulation shall be moisture resistant, Class H, 180°C. Each motor shall be NEMA Design B for continuous duty at 40°C ambient temperature and designed for at least 30 starts per hour.

B. Oil-Cooled Motors: Each pump shall be driven by a dielectric oil-filled, totally submersible electric motor manufactured by the pump manufacturer. Each motor shall be rated 460 volts, 60 Hz, three-phase and shall have a service factor of 1.15. The motor nameplate rating shall exceed the maximum horsepower required by the pump in the operating head of the entire pump curve. The motor shall operate over the entire range of the pump curve without overloading the motor or operating in the service factor of the motor. The stator housing shall be an oil-filled, watertight casing. Motor insulation shall be moisture resistant, Class F, 155°C. Each motor shall be NEMA Design B for continuous duty at 40°C ambient temperature and designed for at least 30 starts per hour.

C. The motor bearings shall be antifriction, permanently lubricated type. The lower bearing shall be fixed to carry the pump thrust and the upper bearing free to move axially. The bearing shall have a calculated AFBMA L10 Life Rating of 40,000 hours when operating at maximum operating head.

D. Each motor shall be capable of continuous operation in air (unsubmerged) for at least 24 hours under pump full load conditions without exceeding the temperature rise limits for the motor insulation system.

E. Each pump shall be equipped with one or more multiconductor cable assemblies for power and control. Each multiconductor assembly containing power cables shall be provided with a separate grounding conductor. Each cable assembly shall bear a permanently embossed code or legend indicating that the cable is suitable for submerged use. Cable sizing shall conform to NEC and ICEA requirements. All cables shall be of sufficient length to terminate at the control panel or as otherwise indicated in the Drawings, with 10 feet of slack which will be coiled in

the pump intake basin. Each cable shall be supported by AISI Series 300 corrosion-resistant stainless-steel Kellems or woven grips to prevent damage to the cable insulation. Mounting of cable supports in the basin shall be coordinated by the supplier to prevent damage to the cable. No splicing of cables shall be allowed.

F. The cable entry water seal shall be water tight and include a strain relief.

G. The motor and its integral protective controls shall be explosion proof and rated and labeled for use in a Class I, Division 1, Group D area under submerged and unsubmerged conditions.

2.03 INFLUENT PUMP STATION CONTROLS

A. Panel Enclosure

1. The main panel shall be free-standing NEMA Type 4X, 316 stainless-steel enclosures with internal dead front panel and stainless-steel continuous hinge and pin. The panel shall be located as shown on the Contract Drawings and shall house a programmable logic controller, touch screen operator interface and all relays, motor starter, control power transformers, fuses, and other controls required for a complete and operating system. The panel shall have terminal strips for all wiring connections internal and external to the enclosure. Terminal strips shall be labeled to identify cable terminations as shown on the panel shop drawings. All internal equipment shall be arranged for bottom entry of motor power cables, level float switch and transducer cables, power feed, and remote alarm circuit conduit.
2. The enclosure shall have circuit breaker operating handles mounted through the dead front panel for each motor starter. The door shall be equipped with an integrated keylock.
3. Indicating lights, selector switches, running time meters, and push buttons shall be mounted through the subpanel. All devices mounted through the subpanel shall be weatherproof, NEMA 4X.

B. Panel Wiring

1. All internal component device wiring shall be as normally furnished by the manufacturer. All interconnecting wiring and wiring to terminals for external connection shall be stranded copper, insulated for not less than

600 volts, with a moisture-resistant and flame-retardant covering rated for not less than 90°C.

2. Power wiring shall be minimum 12 AWG. Control wiring shall be minimum 14 AWG.
3. Terminal blocks for external connections shall be suitable for 12 AWG wire and shall be rated 30 amperes at not less than 600 volts. Terminal blocks shall be fabricated complete with marking strip, covers, and pressure connectors. Terminals shall be labeled to agree with identification shown on the supplier's submittal drawings. A terminal shall be provided for each conductor of external circuits. Not less than 8 inches of clearance shall be provided between the terminal strips and the base of the panel to provide space for conduit entrance and wiring. Not less than 25% spare terminals shall be provided.
4. All wiring shall be grouped or cabled and firmly supported inside the panel. Wiring shall be bundled in groups and bound by nylon cable ties or shall be routed in Panduit or similar nonmetallic slotted ducts. Ducts shall be readily accessible within the panel with removable covers and shall have a space of at least 40% of the depth of the duct available for future use after installation is complete and all field wiring installed. Sufficient space shall be provided between cable groups or ducts and terminal blocks for easy installation or removal of cables.

C. Controls

1. The pump controls shall be designed to alternate the lead pump each time the lead level setpoint calls for a pump to start. Control panel circuitry shall be 120 volt, single-phase, 60 Hz. Control wiring between the control panel and the wetwell or tank shall be 24 volts AC, intrinsically safe. A control power transformer (CPT) shall be provided and mounted in the control panel and sized to serve all continuous loads, including motor starter coils.

2. A "Hand-Off-Auto" selector switch and speed potentiometer shall be provided for each pump. In the ON position pumps may be started and stopped independent of the level controls. In the AUTO position pumps shall be controlled by the level setpoints.

3. Pump Station Control Description: The control system station shall operate the pumps as described below based on the level setting shown on the Drawings:

    a. On rising level with pumps initially off, the Lead Pump On setpoint shall initiate the starting of the lead pump. The lead pump will start at an operator selected minimum speed. The pump will

increase speed if the water level rises until full speed is reached. If the level continues to rise, the Lag Pump On level setpoint shall initiate the starting of the lag pump.

b. On falling level with pumps initially on, the low setpoint shall slow all pumps to a complete stop over an operator selected time. A Redundant Low-level alarm switch shall provide backup for the Low level setpoint and shall stop both pumps. The low-level alarm shall continue to alarm until manually reset.

c. A backup relay system independent of the PLC shall be included in the design of the control system. The relay and timers shall be initiated upon activation of the high-level float. When activated the relays and timer shall transmit a preset speed commend to the remote drive for starting are the first pump for a preset time. If the high float in not satisfied, then a timer will start the second pump at a preset speed. Both pumps will operate until the low float is activated. A manual reset pushbutton will require setting to return to PLC control.

4. Air- Cooled Motors: Each motor shall be protected by motor temperature switches mounted in each phase winding. The air-filled chamber shall be provided with a moisture-detection system. The system shall be furnished by the pump manufacturer, complete with all sensors, cables, control power transformers, intrinsically safe control modules, auxiliary relays, junction boxes, and control enclosures. The monitoring devices shall be suitable for operation with a 24-volt ac supply from the CPT, provide output contacts rated at least 5 amperes at 120 volts AC, and shall be provided with automatic reset.

5. Oil-Cooled Motors: Each motor shall be protected by motor temperature sensors mounted directly in the stator. The sensors shall be connected in series with the motor starter coil so that the starter is tripped if a heat sensor opens.

6. The following local indicating lights shall be provided on the OIT each pump:

Function	Color
Pump Overload/High Temperature	Amber
Pump On	Red
Pump Off	Green
Pump Motor Moisture	Amber

All local indicating lights shall be LED-type lights.

7. The following additional local indicating lights shall be provided on the OIT panel:

Function	Color
Control Power On	White
HL Alarm	White
LL Alarm	White

8. The alarm shall produce a minimum of 1000-effective-candlepower intensity and shall be mounted along with the horn, on the exterior of the building . The alarm strobe shall remain active until reset by a pushbutton on the front of the control panel. The panel shall be equipped with an alarm silence button. The alarm light shall remain until reset by a push button on the dead front portion of the control panel.

9. Motor starters shall be provided in the control panel for the mixer only. The pumps shall be controlled with variable frequency drives located in a remote MCC. Motor starters shall be circuit breaker combination type consisting of three-phase, 60-Hz contactors with overloads, a 120-volt ac coil, and a circuit breaker disconnect.

10. Circuit breakers shall be 600-volt magnetic only motor circuit protectors with 22,000 AIC ratings. Each breaker shall be manually operated with a quick-make, quick-break, trip-free toggle mechanism.

11. A generator receptacle with cover plate shall be provided on the panel. The receptacle shall be a 45º-type unit and shall be easily accessible for connecting to the generator plug. The generator receptacle shall be a reversible-type receptacle. The generator receptacle shall be compatible with the power service to the pumps and shall be by Appleton, Hubbell, or Engineer-approved equal.

12. The control panel shall have an elapsed-run-time meter for each pump that is not resettable. Each elapsed run-time meter shall measure in hours and have read up to 99,999 hours before rolling over to 0.

13. All wiring to the basin shall be intrinsically safe.

14. Terminal strips shall be by Marathon or Engineer-approved equal.

15. Each control panel shall have a GFCI duplex-power receptacle rated at 20 amps. The receptacle shall provide 120-volt AC service.

16. The pump controls shall be implemented with a programmable logic controller and manufactured by Rockwell CompactLogix with related

power supply and I/O modules. In addition, the panel shall include an 8-inch color touchscreen as manufacturered by Rockwell PanelView. The panel shall utilize an unmanaged ethernet switch with fiberoptic ports for interfacing with the plant SCADA system. Panel to include fiber patch panel and media converters.

D. Intrinsically Safe Relays: Connection to switches in the basins shall be made through intrinsically safe relays. Relays shall be solid-state electronic type in which the energy level of the sensing or actuation circuit is low enough to allow safe use in hazardous areas. Relays shall be located in the control panel. Relays shall be Consolidated Electric of Gems "Safe-Pak."

2.04 WETWELL INSTRUMENTATION

A. Float switches shall be of the suspended type with polypropylene or PVC body. Units shall have an integral electrical cable with two #19 AWG stranded conductors. Switches shall be pilot duty, normally open or normally closed, as required for the application.

B. Float switches shall be a direct-acting float switch which contains a mercury switch. Float switches shall be as specified below. The control panel shall have adjustable time delay switches (0 seconds to 300 seconds) so that the pump does not “chatter.” No splicing of the float switch cable shall be allowed. An extra 6 feet of looped float switch cable shall be looped and neatly tied in the basin with plastic ties.

C. The wetwell level transducer shall be submersible type, DC powered, Class 1, Division 1 rated as manufactured by Endress Hauser or Blue Ribbon Birdcage.

2.05 IN-PLANT PUMP STATION CONTROLS

A. Panel Enclosure

1. The main panel shall be free-standing NEMA Type 4X, 316 stainless-steel enclosures with internal dead front panel and stainless-steel continuous hinge and pin. The panel shall be located as shown on the Contract Drawings and shall house all relays, motor starters, control power transformers, fuses, and other controls required for a complete and operating system. The panel shall have terminal strips for all wiring connections internal and external to the enclosure. Terminal strips shall be labeled to identify cable terminations as shown on the panel shop drawings. All internal equipment shall be arranged for bottom entry of

motor power cables, level float switch and transducer cables, power feed, and remote alarm circuit conduit.

2. The enclosure shall have circuit breaker operating handles mounted through the dead front panel for each motor starter. The door shall be equipped with an integrated keylock.
3. Indicating lights, selector switches, running time meters, and push buttons shall be mounted through the subpanel. All devices mounted through the subpanel shall be weatherproof, NEMA 4X.

B. Panel Wiring

1. All internal component device wiring shall be as normally furnished by the manufacturer. All interconnecting wiring and wiring to terminals for external connection shall be stranded copper, insulated for not less than 600 volts, with a moisture-resistant and flame-retardant covering rated for not less than 90°C.
2. Power wiring shall be minimum 12 AWG. Control wiring shall be minimum 14 AWG.
3. Terminal blocks for external connections shall be suitable for 12 AWG wire and shall be rated 30 amperes at not less than 600 volts. Terminal blocks shall be fabricated complete with marking strip, covers, and pressure connectors. Terminals shall be labeled to agree with identification shown on the supplier's submittal drawings. A terminal shall be provided for each conductor of external circuits. Not less than 8 inches of clearance shall be provided between the terminal strips and the base of the panel to provide space for conduit entrance and wiring. Not less than 25% spare terminals shall be provided.
4. All wiring shall be grouped or cabled and firmly supported inside the panel. Wiring shall be bundled in groups and bound by nylon cable ties or shall be routed in Panduit or similar nonmetallic slotted ducts. Ducts shall be readily accessible within the panel with removable covers and shall have a space of at least 40% of the depth of the duct available for future use after installation is complete and all field wiring installed. Sufficient space shall be provided between cable groups or ducts and terminal blocks for easy installation or removal of cables.

C. Controls

1. The pump controls shall be designed to alternate the lead pump each time the lead level setpoint calls for a pump to start. Control panel circuitry shall be 120 volt, single-phase, 60 Hz. Control wiring between the control panel and the wetwell or tank shall be 24 volts AC, intrinsically safe. A control power transformer (CPT) shall be provided and mounted in the

control panel and sized to serve all continuous loads, including motor starter coils.

2. A "Hand-Off-Auto" selector switch and speed potentiometer shall be provided for each pump. In the ON position pumps may be started and stopped independent of the level controls. In the AUTO position pumps shall be controlled by the level setpoints.

3. Pump Station Control Description: The control system station shall operate the pumps as described below based on the level setting shown on the Drawings:

    a. On rising level with pumps initially off, the Lead Pump On switch shall initiate the starting of the lead pump. The lead pump will start at an operator selected speed. The pump will increase speed if the water level rises until full speed is reached. If the level continues to rise, the Lag Pump On level switch shall initiate the starting of the lag pump. A Redundant High level alarm switch shall provide backup for the Lead and Lag On level switches and shall turn on all pumps.
    b. On falling level with pumps initially on, the Low switch shall slow all pumps to a complete stop over an operator selected time. A Redundant Low-level alarm switch shall provide backup for the Low level switch and shall stop both pumps. The low-level alarm shall continue to alarm until manually reset.

4. Air- Cooled Motors: Each motor shall be protected by motor temperature switches mounted in each phase winding. The air-filled chamber shall be provided with a moisture-detection system. The system shall be furnished by the pump manufacturer, complete with all sensors, cables, control power transformers, intrinsically safe control modules, auxiliary relays, junction boxes, and control enclosures. The monitoring devices shall be suitable for operation with a 24-volt ac supply from the CPT, provide output contacts rated at least 5 amperes at 120 volts AC, and shall be provided with automatic reset.

5. Oil-Cooled Motors: Each motor shall be protected by motor temperature sensors mounted directly in the stator. The sensors shall be connected in series with the motor starter coil so that the starter is tripped if a heat sensor opens.

6. The following local indicating lights shall be provided on the front of the panel for each pump:

Function	Color
Pump Overload/High Temperature	White
Pump On	Red
Pump Off	Green
Pump Motor Moisture	White

All local indicating lights shall be LED-type lights.

7. The following additional local indicating lights shall be provided on the front of the panel:

Function	Color
Control Power On	White
HL Alarm	White
LL Alarm	White

8. Two normally open and two normally closed alarm contacts shall be provided for remote annunciation. A common alarm shall indicate motor overload, high motor temperature, high water level, and low water level. Local indication of the common alarm shall be by a red xenon strobe alarm strobe. The alarm shall produce a minimum of 1000-effective-candlepower intensity and shall be mounted along with the horn, on the exterior of the building . The alarm strobe shall remain active until reset by a pushbutton on the front of the control panel. The panel shall be equipped with an alarm silence button. The alarm light shall remain until reset by a push button on the dead front portion of the control panel.

9. Motor starters shall be provided in the control panel mixer. Motor starters shall be circuit breaker combination type consisting of three-phase, 60-Hz contactors with electronic overloads, a 120-volt ac coil, and a circuit breaker disconnect. Motor starters shall be as specified in Division 16, Electrical.

10. Circuit breakers shall be 600-volt magnetic motor circuit protectors with 22,000 AIC ratings. Each breaker shall be manually operated with a quick-make, quick-break, trip-free toggle mechanism.

11. A generator receptacle with cover plate shall be provided on the panel. The receptacle shall be a 45º-type unit and shall be easily accessible for connecting to the generator plug. The generator receptacle shall be a reversible-type receptacle. The generator receptacle shall be compatible

with the power service to the pumps and shall be by Appleton, Hubbell, or Engineer-approved equal.

12. The control panel shall have an elapsed-run-time meter for each pump that is not resettable. Each elapsed run-time meter shall measure in hours and have read up to 99,999 hours before rolling over to 0.

13. Terminal strips shall be by Marathon or Engineer-approved equal.

14. Each control panel shall have a GFCI duplex-power receptacle rated at 20 amps. The receptacle shall provide 120-volt AC service.

2.06 FLOAT SWITCHES

A. Float switches shall be of the suspended type with polypropylene or PVC body. Units shall have an integral electrical cable with two #19 AWG stranded conductors. Switches shall be pilot duty, normally open or normally closed, as required for the application.

B. Float switches shall be a direct-acting float switch which contains a mercury switch. Float switches shall be as specified below. The control panel shall have adjustable time delay switches (0 seconds to 300 seconds) so that the pump does not "chatter." No splicing of the float switch cable shall be allowed. An extra 6 feet of looped float switch cable shall be looped and neatly tied in the basin with plastic ties.

2.07 REJECT PUMP STATION CONTROLS

A. The controls related to the reject pumps will be furnished by the SCADA system supplier. The pump manufacturer shall provide the moisture protection relay for installation by others.

2.08 PIPES, FITTINGS, AND VALVES

A. Piping, fittings, and valves shall be provided where indicated on the Drawings and conform to the requirements of relevant sections.

2.09 GUIDE RAIL AND LIFTING SYSTEM

A. Sliding Bracket: Each pumping unit shall be provided with an integral non-sparking, self-aligning guiderail sliding bracket. The bracket shall be designed to obtain a wedging action between flange faces as final alignment of the pump occurs in the connected position. The entire weight of the pump unit shall be wedged tightly against the inlet flange, making metal-to-metal contact with the

pump discharge forming a seal without the use of bolts, gaskets, or O-rings. The bracket shall maintain proper contact and a suitably sealed connection between flange faces under all operating conditions.

B. Guide Rails: Each pumping unit shall be equipped with two Type 316 stainless-steel guide rails. Guide rails shall be sized by the pump manufacturer to fit the discharge base and the sliding bracket and shall extend upwards from the discharge base to the access open at the top of the pump basin. An upper guide rail bracket of AISI Type 316 stainless steel shall be provided.

C. Lifting Chain: The pump manufacturer shall select and provide a stainless-steel lifting chain suitable for removing and installing each pump. The lifting chain shall be connected to a Type 316 stainless-steel lifting bail that is an integral part of the pump. A suitable Type 304 stainless-steel chain hook shall be provided at the top of the basin.

2.10 ACCESS HATCH COVER

A. The pump manufacturer shall furnish new access hatch covers and all embedded items shall be shipped to the pre-cast manufacturer to be cast into the structures. All coordination shall be the Contractor's responsibility. Access covers and accessories shall be as specified in Section 05500, Metal Fabrications, except as otherwise specified in this Section. The cover shall be of all-aluminum construction and suitable for a live load of 300 pounds per square foot with a maximum deflection of L/240. The cover shall be a reinforced diamond pattern checkered plate. Structural shapes and plates shall be at least 1/4-inch thick. Each leaf shall be provided with two hinges, torsion bars, or other devices to help open an automatic hold-open arm, a retractable handle, and a padlock hasp. The frame shall be provided with strap anchors bolted or welded to the exterior and shall be provided with a lifting chain hook and a guiderail support bracket. All aluminum surfaces to be in contact with concrete or mortar shall be coated in accordance with Section 09900, Painting and Coating.

2.11 MISCELLANEOUS

A. All metal fabrications, hangers, and hardware in the lift station(s) shall be Type 316 stainless steel.

2.12 JOINTS AND PENETRATIONS

A. Joints and lift station(s) penetrations shall be as specified and detailed on the Drawings.

2.13 ANCHOR BOLTS

A. Discharge connection anchor bolts shall be Type 316 stainless-steel epoxy anchors, not less than 3/4-inch diameter, designed for embedment in the concrete wet well or tank floor. The anchor bolts and positioning templates shall be furnished by the pump manufacturer. All other anchor bolts shall be Type 316 stainless-steel epoxy anchors.

PART 3 EXECUTION

3.01 GENERAL

A. Pumps, guide rails, control panel, and appurtenances shall be installed as indicated, in accordance with the Drawings and the manufacturer's instructions. The Contractor shall provide services required to install the pumps, piping, panel, and accessories and perform wiring to connect pumps, level sensors, etc., with the control panel and the control panel with power as required to place the pumping system in service in accordance with requirements of the Contract Documents, all local codes, and NFPA 70.

B. Each discharge base shall be leveled, plumbed, aligned, and wedged into position to fit connecting piping. Installation procedures shall be as recommended by the pump manufacturer and Hydraulic Institute Standards.

3.02 PAINTING

A. All painting and associated work shall be performed in accordance with the paint manufacturer's recommendations for the particular application.

3.03 TESTS

Commercial testing shall be required and include the following:

A. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase, and hertz.

B. The motor and seal housing chambers shall be hi-potted to test for moisture content and/or insulation defects.

C. The pump shall be allowed to run dry to check for proper rotation.

D. Discharge piping shall be attached, the pump submerged in water, and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked

with a bridge to determine if an unbalanced resistance exists. If so, the stator will be replaced.

3.04 FIELD REPRESENTATIVE

A. A representative of the submersible centrifugal non-clog pump manufacturer hired by the Contractor shall inspect the pump installation and direct the startup of the station(s) and shall instruct representatives of the Owner in startup and operation procedures. The Contractor shall procure the services of a representative of the submersible centrifugal non-clog pump manufacturer for the startup and training services required in Table 11000-1 of Section 11000, General Equipment Requirements.

B. The manufacturer's services specified represent an absolute minimum acceptable level of service and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall procure, at no additional cost to the Owner, all services required, including additional or extended trips to the job site by the manufacturer's representative to comply with these requirements.

END OF SECTION

SECTION 11550
COARSE-BUBBLE DIFFUSED-AERATION SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required for the complete, new stainless-steel coarse-bubble diffused-aeration system and appurtenances for Equalization Basin Nos. 1 and 2, Re-Aeration Basin Nos. 1 and 2, and Leachate Tank Nos. 1 and 2. The diffused aeration system shall be furnished and installed complete and ready for aeration and mixing. The Contractor shall coordinate the submitted and approved BNR Package Plant and Leachate Tank Submittals with the Diffuser Manufacturer to allow an appropriate design with the selected tanks.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Complete description of the coarse-bubble diffused-aeration system, which shall include information for the diffusers, the low-pressure air (LPA) drop pipes, manifold pipes, header pipes, drop pipe brackets, header pipe supports, manifold pipe supports, anchorage details, expansion joints, gaskets, bolts, nuts, and washers, and all materials used and as generally shown in drawings.
2. Detailed Plan and Elevation Drawing(s) of the proposed aeration system layout for the aerobic digesters, showing LPA drop pipes, manifold pipes, header pipes, pipe sizes and lengths, and the elevation and location of all diffusers, supports, and expansion joints, and locations and types of all field welds.
3. Complete engineering calculations to show estimated aerobic digester aeration system performance data including standard oxygen transfer efficiency (SOTE).
4. Diffuser, diffuser connector, and system headloss curves covering the range of diffuser airflow rates specified under Article 2.01.
5. Addresses and phone numbers of the nearest manufacturer's authorized service sales representative.
6. The manufacturer's certification of proper installation (see Section 11000, General Equipment Requirements, for Manufacturer’s Certificate of Compliance form).
7. The manufacturer's certificate of warranty.

8. The manufacturer's written certification that all applicable stainless steel aeration system components were cleaned (passivated) according to the requirements contained in this Section.
9. Written list of any requested exceptions to the Specification.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI 304/L—Stainless Steel Wire Mesh.
2. AISI 316—Stainless Steel Ball Bearings.
3. AISI 4142—Heat Treated Steel Specifications.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A106/A106M—Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
3. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
4. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
5. ASTM A283/A283M—Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
6. ASTM A304—Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements.
7. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1,040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

C. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.

D. American Water Works Association (AWWA)

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements. The Contractor shall:

1. Provide only ASTM-certified construction materials.
2. Follow manufacturers' written handling and installation instructions.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for 1 year. The warranty period shall begin at the date of substantial completion.

C. The manufacturer shall warrant all parts, with the exception of the diffusers and diffuser connectors, free from defective material and workmanship for 1 year. The diffusers and diffuser connectors shall be warranted for 5 years. Manufacturer shall provide a written warranty between the manufacturer and the Owner for the additional 4-year period.

D. The warranty shall cover replacement equipment materials, parts, and/or repair, including labor, travel time, shipping costs, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period.

1.06 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.07 MAINTENANCE

A. The following spare parts shall be furnished and shall be suitably marked and boxed for shipment and storage:

1. Ten 24-inch coarse-bubble diffusers (ready for installation on the LPA air header).
2. Ten EPDM flapper valves.
3. Four LPA header pipe support brackets for 4-inch LPA pipe.
4. Four LPA header pipe support brackets for 6-inch LPA pipe.
5. Four LPA manifold pipe support brackets for 8-inch LPA pipe.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. The Contractor shall provide O&M manuals items for the items specified in this Section in accordance with Section 01830, Operations and Maintenance Manuals. Manuals shall include:

1. Name, address, and telephone number of the nearest factory-authorized service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance, and trouble-shooting information, including standard routine operating and maintenance procedures, startup, shutdown, and emergency operations.
4. Complete maintenance parts list.
5. Complete connection, interconnecting, and assembly diagrams.
6. Approved shop drawings.

1.09 SPECIAL CONSIDERATIONS

A. The Contractor shall obtain the Engineer's approval for all of the submittals related to the equipment specified in this Section before forwarding to the Engineer any submittals related to the structural construction of the Equalization Basins, Re-Aeration Basins, and Leachate Tanks as shown on the Drawings.

1.10 DEFINITIONS

A. SCFM: *Standard cubic feet per minute* is understood to be air at 68ºF, 14.7 psig, and 36% relative humidity flowing at a rate of 1.0 cubic foot per minute.

B. ICFM: The volume of air in cubic feet per minute (cfm) actually entering the blower inlet at the atmospheric condition specified.

C. SOTR: *Standard oxygen transfer rate* is understood to be the rate of oxygen transferred to clean water (pounds of oxygen per hour) at standard conditions of 20ºC, 0.0 mg/L residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

D. SOTE: *Standard oxygen transfer efficiency* is understood to be the fraction of oxygen transferred to clean water under standard conditions of 20ºC, 0.0 mg/L residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

E. SWD: *Sidewater depth* is understood to be the interior dimension (as measured along the inside face of the aerobic digester basins and aerobic digester basin walls) from the structure base to the average water surface.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. General

1. The coarse-bubble diffused-aeration system shall be designed and orifices sized (if required) so that at minimum and maximum airflows the airflow rate output of any two diffusers in the same aerobic digester basin shall not differ by more than 10%. The distribution and balancing of air shall be controlled by the use of orifices and proper LPA header pipe size selection only.
2. The coarse-bubble diffused-aeration system shall be designed to provide adequate mixing throughout the Equalization Basins, Re-Aeration Basins, and Leachate Pump Station at the stated airflow requirements. *Adequate mixing* shall be defined as a variation in mixed solids (total residue) of less than 15% between the mean value of samples taken at any two depths along any vertical line extending between the water surface and the top elevation of the diffusers.

B. General Design Requirements:

1. The coarse-bubble diffused-aeration system of Equalization Basin Nos. 1 and 2 shall be capable of providing the following airflows at 10 psig, measured at the top of the LPA drop pipes to each equalization basin:

    a. Equalization Basin No. 1 Design Airflow: 300 SCFM.
    b. Equalization Basin No. 2 Design Airflow: 300 SCFM.

2. Provide airflow balancing orifices for the fine-bubble diffusers to achieve the following air flow distribution within the aeration basins at peak day airflow:

    a. Equalization Basin No. 1: 23.5 SCFM/diffuser.
    b. Equalization Basin No. 2: 23.5 SCFM/diffuser.

3. The centerline of the coarse-bubble diffusers shall be located 2.0 feet from the top of the finished tank floors at an elevation of 180.50. The coarse-bubble diffuser submergence shall be 17.0 feet.

4. The coarse-bubble diffused-aeration system shall be capable of complete and uniform mixing and suspension of the solids concentrations up to 5,000 mg/L.

5. Number of 24-inch coarse-bubble diffusers for the Equalization Basins:

    a. Equalization Basin No. 1: 56.
    b. Equalization Basin No. 2: 56.
    c. Total number of EQ Basin diffusers: 112.

6. The coarse-bubble diffused-aeration system of Reaeration Basin Nos. 1, and 2 shall be capable of providing the following airflows at 30 psig, measured at the top of the LPA drop pipes to each equalization basin:

    a. Reaeration Basin No. 1 Design Airflow: 25 SCFM.
    b. Reaeration Basin No. 2 Design Airflow: 25 SCFM.

7. Provide airflow balancing orifices for the coarse-bubble diffusers to achieve the following air flow distribution within the reaeration basins at peak day airflow:

    a. Reaeration Basin No. 1: 23.5 SCFM/diffuser.
    b. Reaeration Basin No. 2: 23.5 SCFM/diffuser.

8. The centerline of the coarse-bubble diffusers shall be located 2.0 feet from the top of the finished tank floors at an elevation of 180.50. The coarse-bubble diffuser submergence shall be 17.0 feet.

9. The coarse-bubble diffused-aeration system shall be capable of complete and uniform mixing and suspension of the mixed liquor solids concentrations up to 5,000 mg/L.

10. Number of 24-inch coarse-bubble diffusers for the Re-Aeration Basins:

    a. Reaeration Basin No. 1: 56.
    b. Reaeration Basin No. 2: 56.
    c. Total number of Re-Aeration Basin diffusers: 112.

11. The coarse-bubble diffused-aeration system of Leachate Tanks Nos. 1, and 2 shall be capable of providing the following airflows at 10 psig, measured at the top of the LPA drop pipes to each equalization basin:

    a. Leachate Tank No. 1 Design Airflow: 15 SCFM.
    b. Leachate Tank No. 2 Design Airflow: 15 SCFM.

12. Provide airflow balancing orifices for the coarse-bubble diffusers to achieve the following air flow distribution within the Leachate Tanks at peak day airflow:

    a. Leachate Tank No. 1: 23.5 SCFM/diffuser.
    b. Leachate Tank No. 2: 23.5 SCFM/diffuser.

13. The centerline of the coarse-bubble diffusers shall be located 2.0 feet from the top of the finished tank floors at an elevation of 180.50. The coarse-bubble diffuser submergence shall be 17.0 feet.

14. The coarse-bubble diffused-aeration system shall be capable of complete and uniform mixing and suspension of the aerobic digester solids concentrations up to 5,000 mg/L.

15. Number of 24-inch coarse-bubble diffusers for the Leachate Tanks:

    a. Leachate Tank No. 1: 56.
    b. Leachate Tank No. 2: 56.
    c. Total number of Leachate Tank diffusers: 112.

C. Acceptable manufacturers and models: The coarse-bubble diffused-aeration system shall be manufactured and supplied by:

1. Wilfley-Weber, Inc., Englewood, CO.
2. SSI Aeration, Inc.
3. or Engineer-approved equal.

2.02 GENERAL REQUIREMENTS

A. The coarse-bubble diffused-aeration system shall be suitable for receiving air from positive displacement blowers.

2.03 EQUIPMENT

A. General

1. The coarse-bubble aeration system for Equalization Basins Nos. 1 and 2, Re-Aeration Basins 1 and 2, and Leachate Tanks 1 and 2 shall include but not be limited to a blower discharge stainless steel LPA manifold piping system, including all spools, pipe, fittings, flanges, fasteners required from the aerobic digester blower discharge flanges to the LPA manifold piping; stainless steel LPA drop pipes; stainless steel headers; throttling butterfly

valves; stainless steel elbows; stainless steel cast tees; coarse-bubble diffusers; all LPA manifold, header, and drop piping supports above and below the waterline; sway braces; condensate blow-off assemblies; gaskets; bolts; nuts; and washers.

2. The design and fabrication of the aeration equipment shall be such that upon completion of the installation by the Contractor all diffusers shall be installed to within plus or minus 3/8-inch of a common horizontal plane.
3. All welded parts, supports, and assemblies shall be shop fabricated from Type 304L stainless steel with a 2D finish conforming to AISI 304L and ASTM A240/A240M. Unless specified otherwise, all nonwelded pipe supports and pieces shall be shop-fabricated from sheets and plates of 304 stainless steel conforming to AISI 304 and ASTM A240/A240M. Unless specified otherwise, air piping shall be Schedule 5S minimum.
4. The entire system shall be designed to allow for expansion and contraction over a differential temperature range of 125ºF when installed.

B. LPA Diffuser Drop Pipes: LPA drop pipes shall be Schedule 5S Type 304 stainless steel pipe.

C. Low-Pressure Air (LPA) Manifold: The LPA manifold shall be 12-gauge 304L stainless-steel pipe. Fabricated lengths of the LPA manifold shall not exceed 35 feet in length for shipping.

D. Low-Pressure Air (LPA) Manifold Supports: Provide fabricated stainless-steel supports for LPA manifold.

E. Low-Pressure Air (LPA) Headers: The LPA headers shall be Schedule 5S 304L stainless steel pipe fabricated lengths of the LPA manifold and shall not exceed 35 feet in length for shipping. Changes in diameter shall be accomplished by using eccentric reducers to avoid entrapment or pooling of line condensate.

F. Low-Pressure Air (LPA) Header Support Bracket: Provide Type 304 stainless steel LPA header bracket as shown on the Drawings. Support bracket shall be designed and fabricated with provisions for a 3-inch vertical adjustment of the LPA header piping to facilitate leveling and for desired slopes for condensate drainage. The top of the aeration basin structure varies as shown in the Drawings. The Contractor shall verify support bracket height before fabrication.

G. Cast Tee Diffuser Connectors: Heavy cast tees specifically designed and supplied by the diffuser manufacturer shall be provided and shall connect to the horizontal portion of the diffuser connector. Cast tee diffuser connectors shall be factory welded to the bottom of the LPA header pipes. All diffuser connectors shall be on a common horizontal plane. Each diffuser shall be a single, continuous component. The use of multiple pieces connected by threaded or other such

means shall not be permitted. The connection between the drop pipes and the cast tee diffuser connector shall be capable of withstanding a horizontal or vertical moment of 1,000 inch-pounds, minimum, without permanent deformation. The diffuser connector shall have two 3/4-inch threaded NPT outlet pipe connections for attaching the diffusers. Diffuser connectors not provided with diffusers shall be capped or plugged for future use.

H. Diffusers

1. The diffusers shall be of the coarse-bubble, non-clog type and shall provide full wide-band aeration. Air shall be released uniformly along a 24-inch-long diffuser. Air exit ports shall be located at or below the diffuser connector invert. The diffuser end cap shall have a 3/4-inch NPT pipe connection, as a minimum equivalent to Schedule 80 pipe, for connection to the diffuser connector. The end cap shall be cast conforming to ASTM 296, Grade CF3. Fabricated end caps shall not be accepted. The diffuser end cap/pipe connection shall be capable of withstanding a moment of 500 inch-pounds, minimum, without permanent deformation. The diffusers shall include the check valve feature to prevent liquid from entering the drop pipe when air is not supplied to the diffuser drop assembly.
2. A metallic balancing orifice in each diffuser, if required, shall provide the proper head loss to ensure uniform air distribution throughout the airflow ranges specified under the paragraph Performance Requirements.
3. Gaskets: If required for this project, expansion joints and couplings shall be provided with gaskets forming an airtight connection at 20-psig minimum. Gaskets shall be neoprene, 40 to 60 Durometer.
4. Miscellaneous: Nuts, bolts, washers, and other nonwelded parts shall be Type 304 stainless steel, unless noted or specified otherwise.
5. Diffusers shall operate properly and deliver air uniformly at air flow rates of 5.0 to 30 scfm per diffuser. Couplings, if required, shall be of the flange-follower type.

2.04 ACCESSORIES

A. LPA Manifold and Drop Pipe Isolation/Throttling Butterfly Valves: Butterfly valves shall be ASTM A126 Class B cast-iron body, wafer style, suitable for mounting between ANSI Class 125/150 flanges, and rated to 200 psi WOG. The valve body shall have resilient non-collapsible, mechanically sealed, and field replaceable EPDM full-faced seat rated to the valve body pressure rating. The valve shaft and disc shall be AISI Type 316 stainless steel. The valve handle shall have 10-position locking position feature.

B. Discharge Pressure Gauges: The Contractor shall furnish and install at each blower discharge one 0-10-psig range pressure gauge with a nominal 2 1/2-inch dial size and accuracy of 1.5% (plus or minus) of span. The gauge shall be the liquid-filled type with brass case and copper alloy wetted parts. Gauges shall be WIKA Model Type 213.40, Part No. 9629548, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. The coarse-bubble diffused-aeration system manufacturer's representative shall provide installation assistance to the Contractor to ensure that the system and equipment specified in this Section is installed in conformance with the manufacturer's recommended methods, as approved and as further specified in this Section. The Contractor shall furnish an authorized and technically qualified manufacturer's representative for the following services at the job-site or classroom as designated by the Owner, for the minimum person-days listed below, travel time excluded:

1. One person-day on site for installation assistance, inspection, and certification of the installation.
2. One person-day on site for functional and performance testing, training of Owner personnel, and system startup.

3.02 PAINTING AND SURFACE PREPARATION

A. The Contractor shall paint all of the items specified in this Section in accordance with Section 09900, Painting and Coating.

3.03 FIELD TESTING

A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. Field tests shall be made in conformance with Section 01400, Quality Requirements.

All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory-authorized service representative shall be onsite to perform the testing services specified in this Section for one 8-hour day, excluding travel time.
2. The installation Contractor with assistance from the aeration system manufacturer's authorized representative shall conduct a field airflow test, witnessed by the Engineer. The installed diffused-aeration system and equipment shall be field tested to verify the ability of the system to meet the maximum allowable pressure drop at the maximum airflow rates specified in this Section. The Engineer shall approve the procedures used to conduct this test. Upon completion of the test, the installation contractor shall submit to the Engineer a letter-report documenting the procedures used and the resulting air pressures obtained at the stated locations. The diffuser systems shall provide uniform mixing rolling action with no dead mixing spots in the aerobic digesters.

3.04 TRAINING SERVICES

A. The factory-authorized service representative shall be onsite to perform training services in accordance with Section 11000, General Equipment Requirements, for one 8-hour day, excluding travel time.

3.05 MANUFACTURER’S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer’s Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. The equipment manufacturer shall provide a written report covering his findings and installation approval. The report shall include description of all inspections and any deficiencies noted and shall be mailed directly to the Engineer.

END OF SECTION

SECTION 11551
FINE-BUBBLE DIFFUSED-AERATION SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required for the complete, multilayer polytetrafluoroethylene- (PTFE) coated flexible membrane fine-bubble aeration system in the aeration basins and aerobic digester basins in accordance with the Contract Documents. The diffused-aeration system shall be furnished and installed complete and ready for mixed liquor and waste-activated sludge aeration and mixing. The Contractor shall coordinate the submitted and approved BNR Package Plant Tank Submittal with the Diffuser Manufacturer to allow an appropriate design with the selected tanks.

1.02 SUBMITTALS

A. The Contractor shall submit the following:

1. Complete description of the fine-bubble diffused-aeration system, which shall include information for the low-pressure air (LPA) drop pipes, manifold pipes, header pipes, drop pipe brackets, header pipe supports, manifold pipe supports, anchorage details, expansion joints, gaskets, bolts, nuts, washers, and all materials used and as generally shown in Drawings.
2. Detailed Plan and Elevation Drawing(s) of the proposed aeration system layout for the aerobic digesters showing LPA drop pipes, manifold pipes, header pipes, pipe sizes and lengths, and the elevation and location of all diffusers, supports, and expansion joints, and locations and types of all field welds.
3. Complete engineering calculations to show estimated aerobic digester basin and aeration basin aeration systems performance data including standard oxygen transfer efficiency (SOTE). These include but are not limited to headloss curves and complete headloss calculations for the aeration systems to the manufacturer’s point of responsibility, data from an independent testing laboratory showing the performance characteristics of the diffusers in clean water, minimum laboratory oxygen transfer efficiency offered at the specified side water depth and design airflow conditions, and test data from a depth similar to the design operating depth with similar diffuser density, or an appropriate interpolation between test points normalized to 1,000 milligram per liter (mg/L) total dissolved solids (TDS).

4. Diffuser, diffuser connector, and system headloss curves covering the range of diffuser airflow rates specified under Article 2.01.
5. Addresses and phone numbers of the nearest manufacturer's authorized service sales representative.
6. The manufacturer's certificate of warranty.
7. The manufacturer's written certification that all applicable stainless steel aeration system components were cleaned (passivated) according to the requirements contained in this Section.
8. Written list of any requested exceptions to the Specification.

B. Demonstration of meeting the design requirements described herein.

C. If conforming to certain details of this Section is impossible due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI 304/L—Stainless Steel Wire Mesh.
2. AISI 316—Stainless Steel Ball Bearings.
3. AISI 4142—Heat Treated Steel Specifications.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A106/A106M—Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
3. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
4. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
5. ASTM A283/A283M—Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
6. ASTM A304—Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements.
7. ASTM A380/A380M—Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

8. ASTM D1784—Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
9. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1,040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

C. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.

D. American Water Works Association (AWWA)

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section. The Contractor shall:

1. Provide only ASTM-certified construction materials.
2. Follow manufacturers' written handling and installation instructions.

1.05 WARRANTIES

A. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for 1 year. The warranty period shall begin at the date of substantial completion.

B. The manufacturer shall warrant all parts, with the exception of the diffusers and diffuser connectors, free from defective material and workmanship for 1 year. The diffusers and diffuser connectors shall be warranted for 5 years. Manufacturer shall provide a written warranty between the manufacturer and the Owner for the additional 4-year period. The warranty period shall begin at the date of substantial completion.

C. The warranty shall cover replacement equipment materials, parts, and/or repair, including labor, travel time, shipping costs, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period.

1.06 MAINTENANCE

A. The following spare parts shall be furnished and shall be suitably marked and boxed for shipment and storage:

1. Five AFD270-P diffuser assemblies by SSI Aeration, Inc.
2. Five AFD270-P-2 diffuser assemblies, by SSI Aeration, Inc.
3. Three 3-inch Type 304 stainless steel supports.
4. Two 3-inch polyvinyl chloride (PVC) couplings.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. The Contractor shall provide O&M manuals items for the items specified in this Section. Manuals shall include:

1. Name, address, and telephone number of the nearest factory-authorized service representative who can furnish parts and technical service.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance, and trouble-shooting information, including standard routine operating and maintenance procedures, startup, shutdown, and emergency operations.
4. Complete maintenance parts list.
5. Complete connection, interconnecting, and assembly diagrams.
6. Approved shop drawings.

1.08 DEFINITIONS

A. SCFM: *Standard cubic feet per minute* is understood to be air at 68ºF, 14.7 psig, and 36% relative humidity flowing at a rate of 1.0 cubic foot per minute.

B. ICFM: The volume of air in cubic feet per minute (cfm) actually entering the blower inlet at the atmospheric condition specified.

C. SOTR: *Standard oxygen transfer rate* is understood to be the rate of oxygen transferred to clean water (pounds of oxygen per hour) at standard conditions of 20ºC, 0.0 mg/L residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

D. SOTE: *Standard oxygen transfer efficiency* is understood to be the fraction of oxygen transferred to clean water under standard conditions of 20ºC, 0.0 mg/L residual dissolved oxygen concentration, and a barometric pressure of 760 mm Hg (dry air).

E. SWD: *Sidewater depth* is understood to be the interior dimension (as measured along the inside face of the aerobic digester basins and aerobic digester basin walls) from the structure base to the average water surface.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. General

1. The aeration basins and aerobic digester basins will receive air supply from blowers feeding the air main and subsequently the drop legs. Drop legs will feed each zone to be aerated as shown in the Contract Documents.
2. The fine-bubble diffused-aeration system shall be designed and orifices sized so that at minimum and maximum airflows the airflow rate output of any two diffusers in the same basin shall not differ by more than 10%. The distribution and balancing of air shall be controlled by the use of orifices and proper LPA header pipe size selection only.
3. The fine-bubble diffused-aeration system shall be designed to provide adequate mixing of the mixed liquor suspended solids and the waste-activated sludge throughout the aeration basins and the aerobic digester basins, respectively, at the stated airflow requirements. *Adequate mixing* shall be defined as a variation in mixed solids (total residue) of less than 15% between the mean value of samples taken at any two depths along any vertical line extending between the water surface and the top elevation of the diffusers. Air and mixing rates shall be variable over the range necessary for oxygen transfer and mixing.
4. Maximum diffuser membrane flux rates shall be a maximum of 4 scfm/square foot and maximum spacing between diffuser rows shall be no more than 4 feet from center to center.

B. General Design Requirements

1. The fine-bubble diffused-aeration system shall be capable of providing the following total airflows when installed in both tanks of 19-foot sidewater depth:

a.	Aeration Basin Design Airflow (Avg):	450 SCFM/tank.
b.	Aeration Basin Design Airflow (Max Day):	675 SCFM/tank.
c.	Aerobic Dig. Basin Design Airflow (Avg):	163 SCFM/tank.
d.	Aerobic Dig. Basin Design Airflow (Max):	275 SCFM/tank.

2. Provide airflow balancing orifices for the fine-bubble diffusers to achieve the following air flow distribution within the basins at peak day airflow:

   a. Aeration Basin: 1.55 SCFM/diffuser.
   b. Aerobic Digester Basin: 1.81 SCFM/diffuser.

3. The centerline of the fine-bubble diffusers shall be located 1.5 feet from the top of the finished tank floors at an elevation of 179.0 The fine-bubble diffuser submergence shall be 17.5 feet m.

4. Estimated number of fine-bubble diffusers (per basin):

   a. Aeration Basin: 236.
   b. Aerobic Digester Basin: 90.

C. Acceptable Manufacturers and Models

1. The fine-bubble diffused-aeration system shall be:

   a. Disc Diffuser Model AFD270-P or AFD270-P-2 9-inch disc diffuser with multilayer PTFE coated ethylene-propylene diene monomer (EPDM) membrane manufactured and supplied by SSI Aeration Inc. Engineering, Poughkeepsie, NY.
   b. Or Engineer-approved equal.

2.02 GENERAL REQUIREMENTS

A. The fine-bubble diffused-aeration system shall be suitable for receiving LPA from positive-displacement blowers.

2.03 EQUIPMENT

A. General

1. The fine-bubble membrane disc aeration system shall include but not be limited to stainless steel LPA drop pipes; stainless steel headers; throttling butterfly valves; stainless steel elbows; stainless steel cast tees; fine-bubble diffusers; all LPA manifold, header, and drop piping supports above and below the waterline up to 12 inches above top-of-wall; sway braces; condensate blow-off assemblies; gaskets; bolts; nuts; washers; and all other appurtenances required for a complete and operable system.

2. The design and fabrication of the aeration equipment shall be such that upon completion of the installation by the Contractor all diffusers shall be installed to within plus or minus 3/8 inch of a common horizontal plane.
3. All welded parts, supports, and assemblies shall be shop fabricated from Type 304L stainless steel with a 2D-finish conforming to AISI 304L and ASTM A240/A240M. Unless specified otherwise, all nonwelded pipe supports and pieces shall be shop-fabricated firm sheets and plates of Type 304 stainless steel conforming to AISI 304 and ASTM A240/A240M. Unless specified otherwise, air piping shall be Schedule 5S minimum.
4. The entire system shall be designed to allow for expansion and contraction over a differential temperature range of 125ºF when installed.

B. Stainless Steel Materials and Fabrication

1. Fabricate all welded parts and assemblies from sheets and plates of Type 304L stainless steel. Fabricate non-welded parts and pieces from sheets and plates of Type 304L stainless steel.
2. Pickle all stainless steel assemblies and parts after welding, fabrication, and wire-brushing by complete immersion in an acid solution as specified in ASTM A380. The acid shall be a nitric-hydrofluoric solution as defined in ASTM A380. Provide a final rinse using ordinary industrial or potable water and dry in conformance with ASTM A380. Corrosion protection techniques not employing full immersion methods will not be acceptable.
3. Perform all welding in the factory using metal inert gas (MIG), tungsten inert gas (TIG), or plasma-arc welding inert gas processes. Field welding will not be permitted.

C. PVC Materials and Fabrication

1. Produce all PVC pipe and fittings from PVC compound with a minimum tensile strength of 7,000 psi.
2. Provide lower drop pipes, manifold pipes, and header pipes with a minimum of Schedule 40 wall thickness. Header pipes shall have a minimum outside diameter of 4.5 inches. Pipe shall be produced from PVC Type I Grade I, with a Cell Classification of 12454 as defined in ASTM D1784. Alternates will not be acceptable.
3. Factory solvent-weld all PVC joints. Field solvent welding will not be permitted.
4. Headers shall terminate in removable end caps to facilitate water flushing of the piping before installation of diffusers.
5. One PVC drain line sump with airlift purge ejector line and educator carrier column shall be provided to drain the submerged aeration piping system. The system shall include one ball valve.

D. Membrane Aeration System Equipment Components – Stainless Steel Support Stands

1. Provide Type 304L support stands, including hold-down, guide straps anchor bolts, and supporting structure. Each 20-foot length of pipe shall have a minimum of three support stands. Guide straps shall be a minimum of 1.5 inches wide. Supports shall have a mechanism for 2-inch vertical adjustment for alignment of the manifold in the field. Supports shall be designed to allow for complete removal from the tank (less anchor bolt) to enable cleaning and maintenance of tank bottom. Minimum anchor bolt and threaded rod diameter shall be 3/8 inch. Anchor bolts shall be sized with a pull-out strength design safety factor of 4 or greater.
2. Guide supports shall consist of a self-limiting hold down and sliding mechanism. Hold down and sliding mechanism shall provide a full circumferential 2-inch-wide contoured bearing surface with chamfered leading edges to minimize binding of the air distribution header. The sliding mechanism shall provide minimum resistance to movement of the air distribution header under full buoyant up-lit load. The mechanism shall provide 1/8-inch clearance around header and be self-limiting if the mechanism is over-tightened.
3. Fixed supports shall consist of a self-limiting hold down and sliding mechanism. The hold-down and sliding mechanism shall provide a full circumferential 2-inch-wide contoured bearing surface. The clamping device shall positively grip the air distribution header when tight and be self-limiting to prevent overstressing the header if the clamp is over-tightened.
4. Aligning and adjusting shall be infinitely adjustable within its limits to allow precise leveling of the air distribution headers and diffuser assemblies to within 1/4-inch/6mm of a common horizontal plane without removing the header from the support.
5. Attach supports to tank floor with a minimum of two stainless steel expansion type anchor bolts or Hilti type chemical anchors designed for embedment in 3,000 psi concrete. Supports which use only one anchor bolt or one chemical anchor or that are made of plastic will not be acceptable.

E. Diffusers

1. Connect each diffuser holder to the header with quick threaded saddles. Glued mount connections will not be acceptable.
2. Furnish disc type 9-inch EPDM membrane diffusers with multi-layered fluoro-elastomer encapsulating barrier layer or coating. Single-layer

coatings comprising blended adhesive/PTFE or PTFE powder blended into the EPDM rubber will not be acceptable.

3. The diffuser shall consist of a membrane with integral gasket, base, retaining ring, air flow control orifice, and saddle.
4. Membrane material shall be premium quality compression-molded EPDM membrane with low plasticizer. Coating to be multi-layered grey stretchable dispersion, specifically designed for use with fine-bubble diffusers. The manufacturer shall have a minimum of 5 years of experience manufacturing PTFE-coated EPDM membranes.
5. The membrane shall collapse and seal when the aeration system air is turned off. The membrane shall collapse onto the base when air is not being diffused. The design should permit air to exit through the entire periphery of the membrane. The membrane shall be designed to resist clogging. The following characteristics shall be met:

a.	Surface Layer	PTFE.
b.	Substrate Layer	EPDM.
c.	Tensile strength	2,900 psi.
d.	Ozone resistance	Pass.
e.	Ultraviolet (UV) resistance	Pass.
f.	Durometer	60..
g.	Ultimate elongation	692%
h.	Fats, Oils, and Greases (FOG) resistant	Yes.
i.	Solvent resistant	No.
j.	Biofouling resistant	Yes.

6. The diffuser base and retaining ring shall be constructed of polypropylene with organic UV stabilizers and anti-bacterial agents to prevent bacterial buildup and ease future membrane replacement. Plastics that do not use UV protection shall not be acceptable. The following characteristics shall be met:

a.	Specific Gravity	0.905.
b.	Water absorption	0.02%.
c.	Tensile Strength	5,000 psi.
d.	Coefficient of thermal expansion	5 x 10-5 in/in/°F.
e.	Maximum Temperature	212°F.

7. Furnish factory assembled and mounted 9-inch disc diffusers, which are press-fit into PVC lateral pipes, with retaining rings factory torqued to the proper settings. No field assembly of membranes, plates, saddles, wedges, grease, or otherwise will be allowed, other than final adjustments during factory startup and commissioning. Proof of a million-cycle test against pull-out at extreme temperature and load conditions to be provided.

8. The diffuser shall be designed to prevent air escape at the seal. The gasket shall be integral with diffuser membrane.
9. The sealing method of the retaining device shall generate a minimum of 50 pounds per inch of circumference of the sealing gasket to provide a long-term positive seal and to prevent air escape.

2.04 ACCESSORIES

A. LPA Manifold, Lifting Lugs (with wire rope to facilitate the grid to retrieve), and Drop Pipe Isolation/Throttling Butterfly Valves: Butterfly valves shall be ASTM A126 Class B cast-iron body, wafer style, suitable for mounting between ANSI Class 125/150 flanges, and rated to 200 psi WOG. The valve body shall have resilient non-collapsible, mechanically sealed, and field replaceable EPDM full-faced seat rated to the valve body pressure rating. The valve shaft and disc shall be AISI Type 316 stainless steel. The valve handle shall have 10-position locking position feature.

B. Discharge Pressure Gauges: The Contractor shall furnish and install at each blower discharge one 0-10-psig range pressure gauge with a nominal 2 1/2-inch dial size and accuracy of 1.5% (plus or minus) of span. The gauge shall be the liquid-filled type with brass case and copper alloy wetted parts. Gauges shall be WIKA Model Type 213.40, Part No. 9629548, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The fine-bubble diffused-aeration system manufacturer's representative shall provide installation assistance to the Contractor to ensure that the system and equipment specified in this Section is installed in conformance with the manufacturer's recommended methods, as approved and as further specified in this Section. The Contractor shall furnish an authorized and technically qualified manufacturer's representative as designated by the Engineer and the Owner.

1. Layout and install supports in accordance with instruction and anchor setting plan.
2. Level aeration system such that all diffusers are within 1/4-inch of a common horizontal plane.
3. The top surface of each diffuser shall be horizontal and level.

B. The Contractor shall clean air header pipe, laterals, blowers, filters, and drop legs before installing the diffuser elements.

1. Install diffuser elements on saddles.
2. Protect diffuser elements from unnecessary direct sunlight and excessive heat and cold.

C. The Contractor shall carry out system tests for support stand integrity, pipe joint and diffuser mount leaks, and proper air distribution and mixing in accordance with the manufacturer's recommendations.

3.02 FIELD TESTING

A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section.

1. The factory-authorized service representative shall be onsite to perform the testing services specified in this Section.
2. The installation Contractor with assistance from the aeration system manufacturer's authorized representative shall conduct a field airflow test, witnessed by the Engineer. The installed diffused-aeration system and equipment shall be field tested to verify the ability of the system to meet the maximum allowable pressure drop at the maximum airflow rates specified in this Section. The Engineer shall approve the procedures used to conduct this test. Upon completion of the test, the installation contractor shall submit to the Engineer a letter-report documenting the procedures used and the resulting air pressures obtained at the stated locations. The diffuser systems shall provide uniform mixing rolling action with no dead mixing spots in the aeration basins or aerobic digester basins.
3. After the piping, headers, and diffuser for a basin are installed, the Contractor shall introduce clear water into the tank until the diffusers are covered by approximately 2 inches. Compressed air shall be released through the piping to observe leaks through joints, pipes, or other appurtenances. Any observed leaks shall be repaired, and the test shall be repeated until no leaks are observed.
4. Include a minimum of two 8-hour days of the field engineer's time on-site to independently inspect and test the aeration basins and the aerobic digester basins.

3.03 TRAINING SERVICES

A. The factory-authorized service representative shall be onsite to perform training services. Training shall account for 1 day of the total required time.

B. The Contractor shall schedule in advance with the Owner training for the fine-bubble diffused-aeration system operation and maintenance.

3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section. The certificate shall state that the equipment has been tested, is correctly installed, properly aligned, and ready to be placed in regular operation.

B. The equipment manufacturer shall provide a written report covering his findings and installation approval. The report shall include description of all inspections and any deficiencies noted and shall be mailed directly to the Engineer.

END OF SECTION

SECTION 11600
LABORATORY EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install laboratory equipment and fume hood as required by the Contract Documents, including Drawings, and as detailed in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit the following:

1. Shop drawings in accordance with Section 01330, Submittal and Acceptance.
2. Warranties in accordance with Section 01780, Warranties and Bonds.
3. Manufacturer’s instructions in accordance with Sections 01600, Materials and Equipment, and 01650, Delivery, Storage, and Handling.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Apparatus and supplies shall be packed in identifying containers and when shipped, shall be accompanied by an accurate packing list.

B. The Contractor will accept all equipment on site. Inspect on arrival for damage.

C. The Contractor will store and protect against damage until the supplier's representative arrives to inspect the equipment. (See Article 3.01, Examination and Verification).

1.04 FIELD MEASUREMENTS

A. Verify that field measurements and equipment requirements are as indicated.

1.05 COORDINATION

A. Coordinate work with installation of laboratory casework.

B. Coordinate equipment installation with size, location and installation of service utilities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Laboratory equipment and supplies will be supplied by one supplier: Fisher Scientific, McCalister-Bicknell; or engineer-approved equal.

B. Laboratory equipment and supplies are designated by Fisher Scientific catalog numbers unless otherwise noted. The selected equipment shall be manufactured by the equivalent manufacturer-designated catalog numbers.

PART 3 EXECUTION

3.01 EXAMINATION AND VERIFICATION

A. Verify that rough-in frames, anchors, and supports are accurately placed.

B. In the presence of the Engineer's Field Representative, the following will occur:

1. All apparatus and supplies will be removed from their packing containers, inspected, checked off against the packing list, and placed in their proper positions in the casework and with other laboratory equipment.
2. Missing or defective items shall be supplied or replaced.

3.02 INSTALLATION

A. Install in accordance with the manufacturer’s instructions.

B. Sequence installation to ensure that utility connections are achieved in an orderly and expeditious manner.

3.03 SERVICES OF MANUFACTURER’S REPRESENTATIVE

A. Provide manufacturer's(or supplier's) services according to Section 01650, Delivery, Storage, and Handling.

3.04 SCHEDULE OF EQUIPMENT

A. Equipment referenced by Fisher Catalog Number

ITEM	NUMBER NEEDED	FISHER CATALOG NO.
Timer	1	06-656
Portable DO Meter	1	13-645-557
Carrying Case	1	13-645-596
BOD Bottle Stirring Probe	1	13-642-234
Membrane Kit	1	13-299-16
DO Temperature Compensation Probe	1	13-299-43
Detached Cable (10 feet)	1	13-299-40
Muffle Furnace, 120-Volt, Single-Phase, with Plug to Match Electrical Outlet	1	10-552
Vacuum Pump	1	12-584-506
Electronic Analytical Balance (Metler AJ100)	1	01-914-050
Glass Drying Rack	1	14-810-54A
Autoclave Gloves	2 Pr.	11-394-299
Burners	2	03-962Q
Conductivity Meter	1	13-645-528
Desiccators	2	08-642-15
Microscope with Phase Contrast with Glass Slides	1	03-000-009
Top Loading Balance (0-2100 g)	1	14-557-406
Drying Oven, 120V/Single-Phase with Plug to Match Electrical Outlet	1	15-103-0521
pH Meter, Accumet with Combination Electrode	1	13-636-AE152
ORP Probe	1	
Crucibles	18	FB960R
Evaporating Dishes	24	FB962J
Crucible Tongs	2	15-193
Dessicator Absorbent	1 lb	07-578-4A
600 ml Pyrex Beakers	6	02-540M
Paddle Stirrer with Six Paddles	1	15-443-720
Plainglass Microscope Slides	Case of 10	12-544-1
1 Liter Graduated Cylinder	3	08-550H
1 Liter Flasks	2	K953760-0000
Kontes Vacuum Filter Holder	2	K953755-0000
GF/C 1.2 µm Glass Fiber Filters	100	09-874-35
1/4-Inch Tygon Vacuum Tubing	20-Foot	13-712-82
5.5-Gallon Polyethylene Carboys with Spigots	2	02-963BB
HACH Test N Tube Methods – HACH DR 3900 Spectrophotometer	1	50-199-7796

ITEM	NUMBER NEEDED	FISHER CATALOG NO.
HACH Test N Tube Kits		
COD Reagent Vials	1	50-199-5461
COD Test Tube Rack	1	50-199-5173
COD Reactor	1	50-199-7838
TKN	1	50-199-8164
Nitrate	1	50-199-8130
Nitrite	1	50-199-5511
T-Phosphate	1	50-199-8137
Alkalinity	1	50-199-8155
Free and total Chlorine	1	50-199-8152
Settling Cones	4	15-438
Cone Rack	1	15-443-60
Standard Methods Manual (most recent edition)	1	NC9527159
Hot Plate/Magnetic Stirrer	1	11-676-265

END OF SECTION

SECTION 11605
COMPOSITE SAMPLING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to provide the refrigerated composite sampling systems and appurtenances specified in this Section and shown on the Drawings. Each sampling system (hereafter referred to as *sampler*) shall be capable of automatically collecting flow-proportioned samples composited over programmed durations in accordance with FAC 62-601 at the locations (influent and effluent) shown on the Drawings. The samplers shall be designed to collect samples from raw wastewater (containing 400 mg/L $CBOD_5$, 400 mg/L TSS, pH greater than 6.0 and less than 8.5) and final effluent meeting reclaimed water standards in Florida (containing 5 mg/L TSS or less, 20 mg/L $CBOD_5$ or less, 1 to 10 mg/L total chlorine residual, pH greater than 6.0 and less than 8.5).

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. National Electrical Manufacturer's Association (NEMA)

1. NEMA 4X—Electrical Enclosures.

B. Florida Administrative Code (FAC)

1. FAC 62-601—Domestic Wastewater Treatment Plant Monitoring.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish a complete set of recommended standard spare parts necessary for the first 2 years of operation of the composite samplers, which shall include at least the following:

    a. Desiccant Bag.
    b. Pump Tubing Bundle (five total).
    c. Pump Housing Bushing.
    d. Pump Paddle Assembly.
    e. Distributor Arm Nut.
    f. Discharge Tube.
    g. Suction Line.
    h. Temperature Control Box Assembly.
    i. Evaporation Temperature Sensor Wire Assembly with Sensor.
    j. Air Temperature Sensor Wire Assembly with Sensor.
    k. Ambient Air Temperature Sensor Assembly.

1.09 OPERATION & MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. Influent Sampler.
2. Effluent Sampler.

B. General Design Requirements

1. Number of Samplers: Two.
2. Refrigerator Compressor Motor: 1/5 Hp (Minimum).
3. Electrical Service: 120 V, one-phase, 60 Hz (plug-and-cord connection).
4. Minimum Sample Pump Total Dynamic Head: 15 feet.
5. Minimum Sampling Velocity: 2.0 feet/second (in 3/8-inch suction tubing).

C. Acceptable Manufacturers

1. ISCO, Inc., Model 6712 FR.
2. Or Engineer-approved equal.

2.02 EQUIPMENT

A. General

1. Each sampler shall be designed and fabricated to continuously operate outdoors in non-covered areas without the need for additional enclosures that are not integral to each sampler. The sampler shall be designed for continuous service in a corrosive environment containing hydrogen-sulfide.

2. Each sampler shall automatically collect and route samples from an open-channel or closed pipe to storage containers inside each sampler for off-site analysis.

3. Sample distribution shall be through the use of a worm gear drive mechanism. This system shall lock the corrosion-resistant distribution arm above the appropriate sample container. A dual optical sensor shall provide positive location of the distributor arm. A single adjustable distributor arm shall be used for all bottle configurations and sampler mounting possibilities.

4. Each sampler shall be designed so the sample stream travels directly from the sample source to the sample bottle. Samples shall not pass through metering chambers or other diversions before entering the sample bottle.

5. Each sampler shall include but not necessarily be limited to the following components:

    a. Sampler Enclosure.
    b. Sampler Controller.
    c. Sample Pump.

B. Sampler Enclosure

1. Each sampler enclosure shall consist of a controller cover and refrigerator. The controller cover and exterior and base of the refrigerator shall be constructed of resin transfer molded-fiberglass-reinforced plastic with a UV-resistant gel coating.

    a. Refrigerator:

        (1) All exposed metals in the refrigerator shall be stainless steel unless noted otherwise.
        (2) The refrigerator power supply and solid-state thermostat shall be contained in an NEMA 4X irradiated aluminum enclosure inside the refrigerator base.
        (3) The interior of the refrigerator shall be food-grade ABS plastic and shall inhibit bacterial growth.
        (4) The refrigerator shall include 1-1/2 inches of rigid foamed-in-place urethane insulation on the sides to aid in sample preservation. The top insulation shall consist of 3 inches of rigid urethane insulation. The insulation shall use a non-CFC foaming agent.
        (5) All refrigeration lines shall be copper and sheathed with polyester tubing or phenolic resin. The condenser coil shall be powder coated with polyester for additional corrosion resistance. The refrigerator evaporator plate shall be aluminum and powder coated with a food-grade epoxy to resist corrosion. The refrigerant used shall be a non-CFC liquid with zero ozone depletion potential.
        (6) The refrigerator door shall be hinged and furnished with hasps capable of accepting a padlock. Furnish a magnetic gasket seal around the refrigerator door.
        (7) The refrigerator compressor shall be equipped with a temperature safety cutout to disengage the compressor once

a temperature of 221°F is reached. The refrigeration system shall contain HFC-134a as the refrigerant. The sampler enclosure shall have a maximum of 5 minutes typical recovery time to return to 39°F after the door has been opened for 1 minute in 75°F ambient conditions. The collected samples shall be stored in an enclosure capable of operating in ambient temperatures from -20° to 120°F.

b. Controller Cover:

(1) The controller cover shall be mounted on top of the refrigerator and house the sample controller and sample pump. The controller cover shall be hinged to the top of the refrigerator and furnished with latches that can be padlocked. The controller cover shall be equipped with a temperature control knob in the controller cover interior to control the refrigerator internal temperature.

C. Sampler Controller

1. All electrical and control components for each sampler shall be housed in a single sampler controller housed in a NEMA 4X enclosure constructed of 1/4-inch Noryl® plastic located inside of the controller cover. The interior of the enclosure shall contain a desiccator to prevent moisture damage to electrical components. The sampler controller shall be designed so it can be removed and mounted on a separate, compatible portable sampler.

2. The sampler controller shall have a four-line, 20-character-per-line, 80-total-character display to show the sampler and attached module status and pertinent program information. This display shall be angled for easy viewing and backlit for easy use in all light conditions. A 17-position keypad shall be mounted on the controller to enable the user to program the sampler, provide the user with manual control of the sampler, and perform data transfer functions.

3. Program firmware shall be stored in flash memory modules to allow program software updates to be transferred to the sampler without opening the controller enclosure.

4. The sampler controller shall be designed to regulate and deliver sample volumes with an accuracy of ±10 ml or ±10%, whichever is greater, of the programmed value. The sample volume repeatability shall be ±5 ml or

±5%, whichever is greater, of the average of the maximum and minimum sample volume in the sample set.

5. The sampler controller's firmware shall enable the user to select sample volumes from 10 to 9,990 ml in 1-ml increments.

6. The sampler controller shall be provided with an internal real-time clock to provide time and date information. The clock shall be capable of recording and displaying time information in 1-minute increments up to a maximum of 99 hours and 59 minutes.

7. The sampler controller shall be provided with 512 kilobytes of battery-backed RAM memory with a minimum life of 5 years. This memory shall maintain the sampler's program settings, stored programs, and the results of the last sampling sequence when the sampler is turned off or an external power interruption occurred.

8. The sampler controller shall be provided with a user-initiated diagnostics routine to determine the operational status of the sampler. Any error conditions detected by the diagnostic routines shall be displayed to the user.

9. The sample controller shall contain a non-wetted, non-conductive liquid-detection device (referred to as the *liquid detector*) to sense the presence of liquid in the sampling location. The sensor shall not be dependent on or affected by any chemical or physical property of the liquid or its contents. The sensor shall not require routine maintenance or cleaning.

10. The sampler shall be capable of storing up to five sampling routines. The duration and frequency of purges can be controlled by the user in this mode. Sample retries and line rinses shall be selectable from zero to three. The user shall be able to enter a 10-character alpha numeric description as a sampling site name. The user shall also be able to enter 10-character alphanumeric names for each stored sampling program.

11. The sample controller shall be provided with contacts for the following input and output signals:

    a. Three programmable analog outputs.
    b. One serial data output to remotely transmit ASCII data at user-selectable intervals of 15 seconds, 1 minute, 5 minutes, or 15 minutes at a 9600-baud rate.
    c. One programmable input/output (I/O) port.

d. One SDI-12 input interface capable of accepting up to 10 input signals from an external device compatible with the sampler controller.

D. Sample Pump

1. The sample pump shall be of the peristaltic type and shall be mounted in the controller cover to function with the sampler controller. The pump shall be constructed of high-strength Noryl plastic and designed for corrosion resistance and long tubing life.
2. The sample pump shall air-purge the suction line before and after each sample is collected. Pre-purges and post-purges shall be automatically controlled, and no pre-calibration adjustments shall be required. The sample pump shall be capable of providing variable purge durations as selected by the user.
3. The pump shall include a latched cover and thumbscrew opening for replacing pump tubing.
4. The pump shall include a built-in safety interlock to automatically de-energize the pump motor when the pump's latch and band are opened.
5. The sample pump shall be able to resist a positive suction head of 16 feet (pressure feed) on the influent sampler.

2.03 SAMPLER FUNCTIONS

A. The sampler controller shall perform the functions specified in this Section. These functions shall be pre-programmed into the sampler controller by the manufacturer before shipment to the project site.

1. General: The sampler shall be capable of being programmed by the user to perform specific sampling operational parameters to occur on specific days of the week. An option shall be available to automatically re-run the active program with no user re-activation required. The user shall program the sampler to collect sequential or composite samples at user-definable intervals. A delay to first sample collection shall be programmable in minutes from 0 to 9,999 or by the real-time clock. The user shall be able to enter a 10-character alpha numeric description as a sampling site name. For programs that have delayed or scheduled start times, the sample controller shall display the parameter readings while waiting for the start time. At the sampling program start time, the totalizer shall be reset to display total flow information for the sampling program. Parameter and flow readings shall also be displayed after the program is complete

2. Sampling Programs: The sampler controller shall be capable of being programmed to perform the sampling procedures specified in this Section.

   a. Time-paced Sampling: The sampler shall collect uniform time-paced samples at regular time intervals programmed for a maximum duration of 99 hours and 59 minutes. The sampler shall also be capable of collecting samples at non-uniform intervals as paced by clock time or in specific minute intervals for each sample collected. An additional non-uniform-timed sampling mode shall allow the user to enter the number and volume of samples to collect and a time in which to complete the sampling routine. The sampler shall then randomly select and record each sample collection event.

   b. Flow-paced Sampling: The sampler shall collect samples that are proportional to flows being measured by the influent and effluent flowmeters. Each sampler shall be capable of accepting a 5 to 15V DC flow proportional pulse or 25-millisecond isolated contact closure from each flowmeter for flow pacing. This sampling program shall enable the user to obtain flow-paced samples by the following means:

      (1) The user shall select the number of flow pulses as the flow interval for each sample collection.
      (2) The user shall enter the amount of flow required for each 10 ml of sample. At the sample time the sample volume shall be calculated based on the flow that occurred since the last sample. This collected sample volume will be at least 20 ml, but not more than the bottle volume (or 9990 ml, whichever is smaller).

3. Sampling Distribution: The sample controller shall enable the user to select from the following types of sample distribution:

   a. Samples per Bottle: Shall allow the user to deposit a minimum of 15 samples in each sample container.
   b. Bottles per Sample: Shall allow the user to fill all sample bottles with a single initiation.
   c. Multiple Bottle Compositing: Shall allow the user to place multiple samples in a single bottle while simultaneously creating a duplicate bottle or set of bottles. The sampler shall automatically switch bottles after a programmed period has elapsed or a predetermined number of samples have been collected.

4. Liquid Detection: The liquid detector shall continuously monitor for anomalies in sample flows being delivered to the sample bottles to minimize the effects of changing head, intermittent flow in the suction line, or variable battery conditions on the sample volume. If no liquid is detected at the sampling location at the time the sampler is programmed to collect a sample, the sampler shall be capable of automatically retrying the sampling sequence up to three times at durations programmed by the user. The sampler shall be capable of being programmed to rinse the suction line with the source liquid up to three times if no liquid is detected at the sampling location. The liquid detector shall be used to detect bottle-full conditions when the sampler is operated in the single-bottle-sampling mode.

5. Pump Revolution Counter: Once the sampler has detected liquid at the sampling location, a pump revolution counter shall record the actual sample pump revolutions to determine the sample volume delivery to the storage containers. If liquid flow is interrupted during the sample collection sequence, the detector shall inhibit the pump revolution counter from incrementing until the liquid flow has been restored. The sampler shall automatically compensate for air slugs in the sample being delivered to the sample bottles. The pump revolution counter shall monitor the total number of pump revolutions and alert the user when a pre-selected number of counts has been reached. This tubing life indicator shall alert the user to the need for pump tubing replacement and shall be indicated on the sampler's display screen. The pump tubing used shall be specially treated to minimize water-extractable pollutants. Specially designed bands shall indicate the correct placement of the tubing inside the pump.

2.04 EQUIPMENT CONTROLS AND ALARMS

A. The Contractor shall provide the following control input and output signals to/from each sampler:

1. Influent Sampler:

a. Inputs:

(1) INFLUENT FLOW signal (from influent flowmeter) 4-20mA analog.

b. Outputs:

(1) INFLUENT SAMPLER TROUBLE alarm remote signal transmitted to the Plant Monitoring System for any one of

the following alarm conditions generated by the sampler controller:

(a) No Sample Flow (in suction tubing).
(b) Program Fault Condition.
(c) Sample Pump Jam Condition.

2. Effluent Sampler:

a. Inputs:

(1) EFFLUENT FLOW signal from effluent flowmeter 4-20mA analog.

b. Outputs:

(1) EFFLUENT SAMPLER TROUBLE ALARM remote signal transmitted to the Plant Monitoring System for any one of the following alarm conditions generated by the sampler controller:

(a) No Sample Flow (in suction tubing).
(b) Program Fault Condition.
(c) Sample Pump Jam Condition.

2.05 ACCESSORIES

A. Suction Tubing and Strainer: The Contractor shall furnish 25 feet of suction tubing for each sampler. The Contractor shall install the suction tubing in accordance with the sampler manufacturer's recommendations. The suction line shall be made of 3/8-inch ID vinyl. The suction tubing shall be designed to last for a minimum of 1,000,000 pump counts (one pump revolution shall be equivalent to 12 pump counts). The end of the suction tubing placed in the sampling location shall contain a factory-installed standard 3/8-inch weighted polypropylene non-clogging strainer.

B. Each sampler shall be supplied with three 2.5-gallon polyethylene sample collection containers.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

B. Each sampler shall be anchored to concrete surfaces using AISI Type 316 SS anchor bolts. Anchor bolts shall be furnished by the sampler manufacturer.

3.02 FIELD TESTING

A. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified in this Section. The service representative shall be certified and employed by the manufacturer of the equipment specified. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory-authorized service representative shall be onsite to perform the field-testing services specified in this Section and training services for one 4-hour working day, excluding travel time.

2. Pre-Startup Testing:

    a. Verify that each sampler has been furnished with all of the equipment, functions, controls and accessories specified in this Section and have been installed in accordance with the manufacturer's recommendations.

3. Startup Testing: The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.

    a. Demonstrate that each sampler can automatically collect samples using the time-paced sampling and flow-paced programs specified in this Section in accordance with the manufacturer's requirements. Each sampling program for each sampler shall be enabled and tested for at least 2 hours.
    b. Demonstrate that the liquid detection, pump revolution counting, and sample distribution functions are being performed in accordance with the manufacturer's requirements for each sampling program.

c. Simulate all sampler alarms being monitored by the sampler controller and verify that each alarm is visually displayed by the sampler controller.

4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

3.03 TRAINING SERVICES

A. The factory-authorized service representative shall be onsite to perform training services in accordance with Section 11000, General Equipment Requirements. This training shall be performed in conjunction with the pre-startup and startup testing specified in this Section.

3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13030
SOFTWARE CONTROL BLOCK DESCRIPTIONS

PART 1 GENERAL

1.01 SCOPE

A. This Section provides functional descriptions of the Remote Terminal Unit (RTU/PLC) and computer software requirements for the Process and Instrumentation Controls System (PICS) as indicated in specifications and on the drawings. These descriptions are intended to provide an overview of the operating concept of the plant process equipment rather than describing in detail every operating feature, I/O point, or required set-point.

1. NOTE: The terms Remote Terminal Unit (RTU) and Process Logic Controller (PLC) will be used interchangeably.

B. Refer to Section 1.5 of SCDG The Supplier of the ControlWave RTU/PLC (as identified in Section 13150, Programmable Logic Controllers) shall provide all RTU/PLC and Human Machine Interface (HMI) programming, and graphic configuration as required for completely functional system in accordance with the contract documents.

1. Programming: The Process and Instrumentation Controls System (PICS) Suppliershall configure and program all hardware andnetwork and communications devices required for an operating system plus any testing software required for the factory test. The PICS Supplier is responsible for by programming the BCCP and RTU-CH RTU/PLC’s.

2. Control Hierarchy:Several levels and modes of operational control will exist for the system. Operators will have the ability to monitor and control equipment via local manual controls at the equipment, or via the local RTU/PLC Operator Interface Terminal (OIT) and through the Supervisory Control and Data Acquisition (SCADA) computers. The selection of these operational modes will be made available through the use of hardwired and/or software selector switches.

a. Manual Control (Local). Hardwired local switches Local-Off-Remote (LOR) (or as shown on plans and noted in detailed loop descriptions) provide selection of Local Manual control, or Remote Manual control (via RTU/PLC OIT or via SCADA) control of the equipment. All equipment equipped with Local Manual LOCAL/OFF/REMOTE (LOR) switches in LOCAL will override

all Remote RTU/PLC and SCADA control. This mode is intended primarily for maintenance functions and is not intended for normal process control operation. When the local switch is in REMOTE, the device is under computer (RTU/PLC and/or SCADA) control.

b. Computer Control. When the equipment LOR switch is placed in the REMOTE position, equipment will be controlled by the RTU/PLC in either the REMOTE AUTO or REMOTE MANUAL mode (via a software switch on the RTU/PLC OIT or SCADA screen).

c. REMOTE MANUAL – The Operator can remotely control equipment through software Start/Stop commands and where applicable, speed controlusing software switching on the RTU/PLC OIT or via SCADA screen. The Start/Stop Command shall be wired as one discrete output and programmed as maintained RUN command.

d. REMOTE AUTO – Control is accomplished via RTU/PLC or SCADA automaticcontrol logic strategy.

e. While in the REMOTE AUTO mode, SCADA and RTU/PLC OIT MANUAL commands are not executed by the RTU/PLC control logic.

C. Programming of control logic and configuration of the EXISTING CONTROL SYSTEM with new process graphical screens – HMI software is part of the Workand shall be the responsibility of the PICS Supplier.

PART 2 PRODUCTS

2.01 GENERAL

A. The descriptions are applicable to the software specified in Section 13150, Programmable Logic Controllers.

PART 3 EXECUTION

3.01 RTU/PLC PROGRAMMING FUNCTIONAL REQUIREMENTS

A. The following paragraphs describe general configuration tasks that are required for the system RTU/PLC(s). These tasks shall be programmed in the applicable RTU/PLC. Each RTU/PLC may have multiple instances of each of these tasks, or may have no instances of some or all of these tasks. The input/output lists (located in these documents as specified in the Instrumentation and Control System section) and detailed equipment control descriptions (included herein) should be referenced to determine the requirements for each RTU/PLC.

B. RTU/PLC or HMI requirements detailed here will not be repeated in the individual control loop descriptions, but are required.

C. The following paragraphs cover functional requirements of the software, which are generic and may or may not be related to any specific control loop. The requirements apply to both the local OITs and SCADA computers. Control functionality will be identical for all sites.

D. Abbreviations: The following abbreviations are used in the control descriptions:

1.	AM	Auto-Manual
2.	HOA	Hand-Off-Auto
3.	LR	Local-Remote
4.	LOR	Local-Off-Remote
5.	RS	Run-Stop
6.	OC	Open-Close
7.	OSC	Open-Stop-Close
8.	OO	On-Off
9.	PV	Process Variable
10.	SP	Set Point (variable)

E. Available Process Values: All generated process alarm, equipment status, and process variable values associated with a particular RTU/PLC shall be available at its OIT and also on SCADA HMI including remote displays (PCWS). Refer to HMI specification for additional requirements.

F. Flow Totalized Values:Flow values shall be integrated, totalized, and stored in the RTU/PLC registers so the values displayed on the Primary Control Panel (PCP) OIT and SCADA computers will be identical.

1. For each flow meter whose analog “flow” signal is monitored by a RTU/PLC or for any calculated flow signal utilized for process control and monitoring, internal flow totalization shall be accumulated by the respective RTU/PLC. The flow totalization routine shall utilize floating point variables to accomplish the flow integration.
2. Two flow totals shall be accumulated and accessible from the RTU/PLC. The current 24-hour period total, the previous 24-hour period total shall be calculated and stored. The 24-hour total shall reset at midnight.
3. The flow total values shall be displayed on the OIT.

G. System Failure: Failure of a RTU/PLC shall result in safe shutdown of associated process equipment. Interposing relays shall be provided where required to assure that equipment will revert to its fail-safe condition. Failure of any RTU/PLC or its communication shall be alarmed.

H. Rack/Module Configuration: The rack and module definitions for each RTU/PLC, as well as the RTU/PLC communications configuration shall be completely configured to allow proper addressing of all field connected I/O points. This shall include configuration of any remote input/output (RIO) racks.

I. RTU/PLC Database Definition: The RTU/PLC database will include both field I/O points and internally generated points required for programming. All field I/O points and internal programming points shall be fully defined according to database naming conventions approved by the Engineer and Owner. As a minimum, each database point shall be provided with a tag name, engineering unit, alarm parameters, and description. Internally generated points (calculations) and set-point variables shall be provided as required whether specified in the control descriptions or not. All process and timer set-points shall be Operator adjustable from the OIT.

J. Analog Scaling: Each analog input and output will be appropriately scaled in engineering units for use in internal RTU/PLC programming and monitoring by the RTU/PLC OIT and remote SCADA computers.

K. Equipment Runtimes: For each equipment item whose "run" status is monitored by a RTU/PLC, an internal equipment runtime shall be accumulated by the respective RTU/PLC. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software timer that maintains equipment runtime to within a one-minute resolution. The timer shall stop incrementing, but not reset, when the "run" contact indicates that the equipment is not running. The timer value shall increment an hour counter that maintains a floating point value representing the equipment run time in hours and tenths of hours. The counter value shall be available for display on the RTU/PLC OIT and SCADA computer. A manual reset of the runtime value shall be available at the RTU/PLC OIT for personnel at the supervisor level and above.

L. Equipment Starts: For each equipment item whose "run" status is monitored by a RTU/PLC, an internal equipment number of ‘Starts’ shall be accumulated by the respective RTU/PLC. The runtime procedure will monitor the status of the equipment "run" contact and, when the equipment is running, increment a software counter that maintains equipment ‘starts’. The counter value shall be available for display on the OIT and SCADA computer. A manual reset of the value shall be available at the HMI for personnel at the supervisor level and above.

M. Change-of-State Alarms: While equipment is controllable from the RTU/PLC (IN REMOTE), discrete output commands shall be compared to their respective

process feedback status signal (where available) to verify proper execution. If the feedback status does not match the most recent output command (after an adjustable time delay), an alarm message shall be displayed on the HMI computer and transmitted to SCADA. The alarm shall remain energized until the proper discrete condition is sensed and until the operator resets the alarm.

N. Equipment Availability: In general, equipment with RTU/PLC control has been provided with a local HOA, HOR, LR, or LOR selector switch that transfers control to the RTU/PLC. The RTU/PLC shall monitor the position of this local selector switch to determine if the equipment is available for RTU/PLC control. If more than one 'switch' or availability condition exists, the 'switches' shall be series hard-wired such that a single signal shall indicate that the equipment is available for RTU/PLC control. If the equipment is not available, the RTU/PLC program shall not attempt to implement remote manual or automatic status changes for the equipment. The RTU/PLC program may, however, need to implement special routines if equipment unavailability affects a sequence (as described in the detailed equipment descriptions).

1. Upon:

    a. Transmitter Failure: Analog signal less than 2 mA or greater than 22 mA.
    b. Pump/Motor Failure: The RTU/PLC shall automatically remove its Call-to-Run and if applicable, set its analog set-point value to a minimum value.
    c. An alarm shall be generated on any failure.

O. Maintained/Momentary Outputs: The need for maintained or momentary control outputs shall be determined from the input/output listing and the electrical schematics. In general, equipment with only one RTU/PLC control output point indicated in the I/O list shall be programmed for a maintained control output. Equipment with two (or more) control outputs shall be programmed for momentary outputs as required. Provisions shall be made, in either case, to remove the active state (start, open, forward, initiate, etc.) control output when an equipment failure is sensed or when the equipment transitions from available to unavailable (local switch change).

P. Power Failure: A utility power failure is detected by the RTU/PLC UPS running from battery power.

1. Upon detection of utility power failure:

    a. A power failure alarm is generated.

2. All RTU/PLC controlled equipment is turned off until main power has been restored for 30 seconds.

3. Upon power restoration for 30 seconds:

    a. A power restored alarm is generated.
    b. Devices will remain in their current configuration. Note that an equipment REMOTE AUTO/REMOTE MANUAL mode may be altered during the power outage if designated in the detailed control strategy.
    c. All devices will require Operator intervention (via RTU/PLC OIT or SCADA) to restart the equipment when not in REMOTE AUTO mode.
    d. All devices over 20 HP shall be stagger-started according to control strategy details.
    e. Control strategy details shall provide additional (if required) actions to occur upon power restoration.

Q. Manual/Auto Bumpless Transfer: Unless otherwise indicated in the equipment control descriptions, equipment changes from automatic to manual control shall be bumpless. Equipment running or stopped in automatic mode shall remain running or stopped when manual mode is selected.

R. RTU/PLC Peer to Peer Ethernet Communications: Each RTU/PLC shall monitor peer-peer RTU/PLC communications required for process control of an equipment system distributed among multiple RTUs/PLCs. Communications failures shall be detected, alarmed, and acted upon in accordance with detailed strategy requirements.

S. RTU/PLC Low Battery: An alarm shall be generated on RTU/PLC low memory low battery detection.

T. RTU/PLC Generated Alarms: Alarms from each RTU/PLC shall be logged into the RTU/PLC OIT alarm log table and displayed as described below. This requirement will not be restated in the individual control loop descriptions.

U. Instrument Calibration: Provide the ability to place all field instruments in a CALIBRATE mode at the SCADA system or OIT. The RTU/PLC will hold last value of the field instrument to allow the plant to operate.

V. RTU/PLC Out of Service mode: An alarm shall be generated on SCADA system when the RTU/PLC is taken out of service.

3.02 OIT FUNCTIONAL REQUIREMENTS

A. The following paragraphs describe general configuration tasks that are required for the OIT and related software:

1. Database: The system database, including field I/O and internal points shall be established according to the database point naming conventions approved by the Owner. Database generation for field I/O shall include all required coordination with RTU/PLC level addresses. All calculated totals, averages, daily totals, etc. calculated by the RTU/PLC in Article 3.01 shall be displayed on the OIT.

2. Alarms: Complete system alarming shall be configured. This shall include configuration of graphical alarm displays, and configuration of audible alarms as available. All process or system alarms shall appear on a dedicated alarm summary screen.

   a. For LOW or LOW-LOW analog or discrete alarms which do not apply if the associated equipment is not operating, provisions shall be made to prevent generation of these alarms. This shall include alarms such as low amperage alarms for pumps that are not running. This may also include low flows or pressures when associated pumps are not operating (this will only apply if periodic operation of the equipment is considered normal).
   b. All alarms/events shall be time stamped when displayed or printed. Unacknowledged alarms shall not automatically clear from the alarm summary if they return to normal before being acknowledged.

B. Manual Entry of Data: The OIT shall allow manual entry data of all Engineer and Owner designated set-points, and process control variables. These variables shall be password protected as indicated in the control descriptions.

3.03 EQUIPMENT CONTROL AND CONTROL MODE OVERVIEW

A. The following paragraphs explain the general format and control modes that are used in the detailed equipment descriptions. These paragraphs apply to the attached, project specific, equipment control descriptions included herein.

B. Descriptions for control are included in the detailed equipment control descriptions. They are provided primarily for overview information and guidance to show intent for the PICS Supplier. The PICS Supplier are responsible for all

detailed programming requirements for safe and proper operation of the equipment provided by them under all conditions.

1. The PICS Supplier and ultimately the Contractor shall be responsible for all coordination issues between their systems to insure they work together in a seamless operation.

3.04 DETAILED EQUIPMENT CONTROL DESCRIPTIONS

A. The following paragraphs describe functional requirements for various software control blocks in the control system. These descriptions are intended to provide an overview of the operational concept for the facilities, rather than describing in detail every operating feature, requirement, or interlock. The programmer is to provide a functioning system, including failure recovery, whether completely or explicitly stated in the control descriptions.

B. Introduction: The purpose of the control strategy is to provide a detailed description of the control, monitoring and alarm functional requirements associated with each process loop for the plant control system (PCS) to operate all the processes associated for the operation of the facility.

C. The process loop number is determined by the ISA tag name. The Instrument Device Schedule in Section 13080, Primary Sensors and Field Instruments, provides a cross-reference between the process loop and the associated control strategy. Each control strategy is divided into sections:

1. Overview: This Section provides a basic performance description as an introductory guide.

2. Monitoring and Control: This Section provides required equipment operation status, current process variable measurements, totaling process variable measurements, and active equipment control mode status that are to be monitored (‘Monitor’ does not include alarms):

    a. Equipment operation status includes OPEN or CLOSED position; ON or OFF; and LOW, HIGH or OFF. (OFF is also referred to ‘READY’ in the electrical schematics wiring diagrams.)
    b. Current process variable measurements include level and pressure.
    c. Totaling process variable measurements include daily, monthly, and annual total measurements; as well as equipment (pumps) cumulative runtimes for daily, weekly, monthly and yearly runtimes.
    d. Active equipment control mode status includes REMOTE selected in the field; MANUAL or AUTO selected from the control system

interface; PID controller's set point and output; operator entered parameters for control algorithms (such as dosage, timers, etc.); current sequence steps.

e. Local (Manual) Display/Control: For equipment and valves that have Local Control Stations (LCS), Local Control Panels (LCP) or Motor Control Panels (MCPs), the Local/Off/Remote (L/O/R) hand switches dictates where the equipment or valves are controlled. In LOCAL Mode, the control is from the LCS, LCP, or MCP via Open/Close pushbuttons or Start/Stop pushbuttons and also speed potentiometers.

3. Remote Control:

a. Manual – In this mode the LCS or LCP must be in REMOTE Mode REMOTE MANUAL Mode – control is forwarded to the OIT. Equipment and valves do not operate automatically but must be "pulsed" open/close (for valves and slide gates) or equipment started/stopped manually. Typical POP-UP graphic templates shall be utilized for all valves, slide gates, pumps, equipment, etc.

b. Auto – Same as Remote Manual Control except: In REMOTE AUTO Mode – control of equipment and valves are controlled automatically from the RTU/PLC as defined below:

(1) Control: This Section provides required modes of equipment operation, mathematical algorithms, proportional-integral-derivative (PID) controller, and sequencing steps. This Section assumes the equipment is placed in AUTO or REMOTE (from the field). If the equipment is not in REMOTE then the described controls are disabled and the equipment is not available for the OIT. The OIT shall alert the operator defining the problem area or piece of equipment Not-In-Auto Mode or that is not functioning properly.

4. Transfer: This Section provides the functional requirements of transferring from one control mode to another control mode. For example, bumpless transfer is the ability to seamlessly go from one mode to another mode without interrupting the equipment operation.

a. Active equipment control mode status includes AUTO or REMOTE selected in the field; MANUAL or AUTO selected from the control system interface; PID controller's set point and output;

operator entered parameters for control algorithms (such as dosage, timers, etc.); current sequence steps.

5. Interlock: This Section provides required control interaction between two or more devices and override functions to protect equipment and process performance under normal operations. It also provides the necessary action to be taken if E-STOP is activated. 'Interlocks' do not include override actions caused by field generated alarms, equipment or instrument failure, and total plant or area power outage.

6. Alarms:

   a. Alarm: This Section provides required annunciation, control action and priority of field generated alarms, logic generated alarms, and logic generated warnings. Logic generated alarms and warnings are identified in the control strategy. These alarms include:

      (1) OOR Analog Input: For all analog inputs, issue an Out of Range (OOR) alarm if an analog input is outside of the 4 to 20 mA range for 30 seconds.
      (2) FAIL-to-CLOSE: If a CLOSE command is issued and there is no CLOSE status feedback to indicate valve has reached full closed position within 45 seconds or the CLOSE status is not present while valve is commanded to CLOSED position, then issue a FAIL-to-CLOSE alarm.
      (3) FAIL-to-OPEN: If an OPEN command is issued and there is no OPEN status feedback to indicate valve has reached full open position within 45 seconds or the OPEN status is not present while valve is commanded to OPEN position, then issue a FAIL-to-OPEN alarm.
      (4) FAIL-to-RUN: If a START command is issued and there is no ON status feedback to indicate device has started within 45 seconds or the ON status is not present while device is running, then issue a FAIL-to-RUN alarm.
      (5) FAIL-to-STOP: If a STOP command is issued and there is still an ON status feedback after 45 seconds from issuing a STOP command, then issue a FAIL-to-STOP alarm.
      (6) FEEDBACK FAILURE: A PID controller modulates a valve position or pump speed to maintain a process set point under AUTO mode and the controller's feedback used to determine off set from set point is ± 5% from the set point for 45 seconds then issue a FEEDBACK FAILURE alarm.

(7) FORCE OVERRIDE: A failure condition occurs that requires the control logic to override a calculated value used for controlling a device such as valve position or pump speed, etc.

(8) NO STANDBY AVAILABLE: The control strategy has a ‘duty’ and ‘standby’ or Lead/Lag service operation under AUTO mode and there is only one pump available for AUTO control then issue a NO STANDBY AVAILABLE warning.

(9) TRACKING FAILURE: A variable speed device or modulating valve is commanded to a speed or position percentage and the feedback from the drive tachometer or actuator positioner is ± 5% from the commanded speed or position for 45 seconds then issue a TRACKING FAILURE alarm.

(10) POWER OUTAGE FORCED STOP: The equipment was running under RTU/PLC control in MANUAL mode prior to loss of power and due to the power outage, the equipment was stopped. Issue a POWER OUTAGE FORCED STOP alarm upon this condition.

7. Fault Mode: This Section provides the functional control requirements in the event that there is an equipment or instrument failure. An equipment failure is defined as the inability to control or monitor a device placed under REMOTE control due to an alarm condition. An instrument failure is defined as the inability to monitor a device due to an alarm condition.

8. Power Outage: This Section provides functional control requirements in the event of a loss of power and the functional control requirements upon power restoration. This Section assumes a power outage to be detected by the transfer of normal to generator power for all processes.

D. HMI Generated Alarms: In addition, alarm priority levels are assigned a number from 1 to 4. The numbers are categorized by the urgency of the alarm condition and are as follows:

PRIORITY	DESCRIPTION
1	Human safety in Danger/Chemical Spill Potential/Toxic Gas Leak.
2	Equipment or system failure; or interlock to shutdown equipment to prevent mechanical damage.
3	Control override to prevent jeopardizing process performance or possible mechanical damage.
4	Warning of potential problem effecting process performance or possible mechanical damage.

E. Introduction to Control Description: The purpose of the control strategy is to provide a detailed description of the control, monitoring and alarm functional requirements associated with each process loop for the Plant's control system (PCS) to operate the following processes:

1. Booster Pump Station

a. General:

(1) During normal operation, the chemical feed systems are off.
(2) When chloramine boosting is desired, the operator will enable the feed systems. The chlorine feed pump will pump at a set rate (Initial 50% pump speed) and the LAS pump will pump an amount corresponding to a 4:1 ratio. The sodium hypochlorite feed pump speed and ratio are operator adjustable.
(3) A low flow setting for the flow rate from the flow meter will prevent the chemical systems from operating if insufficient flow is detected.
(4) Alarms will be programmed for high total chlorine and low free ammonia. The high total chlorine alarm condition will shut the feed systems off.

b. Sodium Hypochlorite Feed System:

(1) Sodium hypochlorite feed system will feed chemical into the mixing system recycle pipe. There are two feed pumps dedicated to this feed. Both pumps are to operate one pump as a standby. Each feed system has a flow meter which will

be monitored for low flow conditions. The flow meter will also be used for inventory management.

(2) Interlocks:

(a) Pump lockout on low flow.
(b) Pump lockout on pump fail, start backup pump.
(c) Pump lockout on low daytank level.
(d) Alarm on high residual.
(e) Alarm and pump lockout on high-high residual.

c. Liquid Ammonia:

(1) Liquid Ammonium Sulfate (LAS) feed system will feed chemical into the mixing system recycle pipe. There are two feed pumps dedicated to this feed. Both pumps are to operate one pump as a standby. Each feed system has a flow meter which will be monitored for low flow conditions. The flow meter will also be used for inventory management.

(2) Interlocks:

(a) Pump lockout on low flow.
(b) Pump lockout on pump fail, start backup pump.
(c) Pump lockout on low daytank level.
(d) Alarm on high residual..
(e) Alarm and pump lockout on high-high residual.

d. The mixing system will include a pump that runs when sufficient volume is measured in the storage tank. There will be an operator adjustable minimum flow through the recycle flow meter for the chemical feed systems to operate. The control for the CL2 feed is based on the monochloramine level; when it drops to a set amount i.e., 2.5 mg/l, the chlorine feed system will pump a calculated flow rate until the monochloramines are increased to a set amount i.e., 4 mg/l. When the chlorine system runs, the liquid ammonia feed system will also pump a calculated flow rate (proportional to the chlorine feed rate; setpoint for the ratio from 3:1 to 5:1. but will have a free ammonia "trim". If the free ammonia exceeds .2 mg/l, the ratio will be "trimmed" to slightly lower the ammonia feed rate. Alarms shall be provided for total chlorine low and high limits and a free ammonia high alarm.

2. High Service Booster Pumps:

a. Target Pressure 65 PSI (Max 80 PSI; Min 40 PSI).

b. Set Staging Speeds and Times (and Pressure Overrides).

c. Stage 1:

(1) Lead 15 HP pump energize if system pressure (PIT-300) is 50 PSI (Max 75 PSI; Min 30 PSI) or below for 90 seconds (Max 999 Sec; Min 1 Sec) or the system pressure drops to 45 PSI for 5 seconds. If the system goes to Stage 2 based on the low pressure setpoint, a reset timer will time 25 seconds (Max 999 Sec; Min 1 Sec) before the staging timer is reset.

(2) Lead 15 HP pump de-energize if the Lead 15 HP pump runs at 76% (Max 100%, Min. 73%) for 45 seconds (Max 999 Sec; Min 1 Sec) or the system pressure rises to 75 PSI for 5 seconds. If the system goes to Stage 0 (no pumps on) based on the high pressure setpoint, a reset timer will time 25 seconds (Max 999 Sec; Min 1 Sec) before the staging timer is reset.

(3) If Lead pump fails, Lag pump to start. If a 15 HP pump is not available, proceed to Stage 2.

d. Stage 2:

(1) Lead 25 HP pump on (Lead 15 HP pump off) if the Lead 15 HP pump runs at 98% (Max 100%, Min. 80%) or above speed for 15 seconds (Max 999 Sec; Min 1 Sec) or the system pressure drops to 45 PSI for 5 seconds. If the system goes to Stage 3 based on the low pressure setpoint, a reset timer will time 25 seconds (Max 999 Sec; Min 1 Sec) before the staging timer is reset.

(2) Back to Stage 1 if the Lead 25 HP pump runs at 80% (Max 100%, Min. 75%) or below speed for 60 seconds (Max 999 Sec; Min 1 Sec) or the system pressure rises to 75 PSI for 5 seconds. If the system goes to Stage 1 based on the high pressure setpoint, a reset timer will time 25 seconds (Max 999 Sec; Min 1 Sec) before the staging timer is reset.

(3) If Lead pump fails, Lag pump to start. If a 25 HP pump is not available, proceed to Stage 3.

e. Stage 3:

(1) Lead 25 HP pump and Lag 25 HP pump on if the Lead 25 HP pump in Stage 2 runs at 98% (Max 100%, Min. 80%) or above speed for 15 seconds (Max 999 Sec; Min 1 Sec) or the system pressure drops to 50 PSI for 5 seconds. Pump speeds shall vary together to maintain the target pressure.

(2) Back to Stage 2 if the 25 HP pumps run at 80% (Max 100%, Min. 80%) or below speed for 60 seconds (Max 999 Sec; Min 1 Sec) or the system pressure rises to 80_ PSI for 5 seconds. If the system goes to Stage 2 based on the high pressure setpoint, a reset timer will time 25 seconds (Max 999 Sec; Min 1 Sec) before the staging timer is reset.

(3) If one 25 HP pump is not available, the Lead and Lag 15 HP pumps will operate with the 15 HP pumps operating 100% speed and the 25 HP pump varying speed to maintain the target pressure.

3. Ground Storage Tank:

a. The control system shall automatically fill the existing storage tank. The existing control logic located in the existing PLC shall be duplicated.

4. Dashboard:

a. A system usage “dashboard” screen shall be created in SCADA. The dashboard screen will show both the storage tanks at the WTP and the Booster Station and the current level/volume in each tank. A calculation of the following items will be displayed:

(1) WTP Tank:

(a) Current Volume of WTP Tank.
(b) Volume Supplied Last 24 Hours Minus Booster Station Tank Fill Volume Supplied (based on Discharge Meter).
(c) % Demand Supplied by WTP.

(2) Booster Station Tank:

(a) Current Volume of Booster Station Tank.

(b) Fill Volume Last 24 Hours (based on Tank Level).
(c) Volume Supplied Last 24 Hours (based on Tank Level).
(d) % Demand Supplied by Booster Station.

b. If not currently programmed, the Booster Station fill and pump operations will be automated within SCADA. Two time periods, operator adjustable setpoints per day will be provided for Tank Fill Begin/Pumps Off and Tank Fill End/Pumps On events.

END OF SECTION

SECTION 13060
FIBER OPTIC CABLING

PART 1 GENERAL

A. Description

1. Scope:

a. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install fiber optic cabling, including fiber testing procedures, accessories and splicing requirements.

B. References

1. Standards referenced in this Section are listed below:

a. ASTM D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
b. ASTM D1603, Test Method for Carbon Black in Olefin Plastics.
c. ASTM D1765, Classification System for Carbon Blacks used in Rubber Products.
d. ASTM D3349, Test Method for Absorption Coefficient of Ethylene Polymer Material Pigmented with Carbon Black.

C. Submittals

1. Shop Drawings – Submit the following:

a. Cut sheets and catalog literature for proposed fiber optic cable, and fiber optic cable accessories (terminations).
b. Manufacturer specifications and data, which clearly and unambiguously shows that the fiber optic cable meets all the requirements specified herein.
c. Samples of the proposed cable.
d. Physical dimension drawings of all fiber optic accessories.
e. Proposed fiber identification sequence and labeling.
f. Provide a Recommended Spare Parts List (RSPL).

D. Maintenance

1. Provide off-line maintenance aids and on-line diagnostics to check the performance of the communication links and interfaces of devices on the data highway.
2. Provide a list of recommended special tools for fiber installation, testing or maintenance.
3. One hand-held optical light source with ATT-compliant SC adapters, Siecor (Corning) Model OS-100S test set, or equal.
4. One hand-held optical power meter with ATT-compliant SC adapters, Siecor (Corning) Model OM-100S, or equal.

PART 2 PRODUCTS

A. Fiber Optic Cable Summary Specifications

1. The fiber optic cable shall meet the following summary specifications:

   a. Fiber Type: Multimode.
   b. Fiber Count: Sic.
   c. Cable Weight: 49 lbs/1,000 feet.
   d. Buffer Type: Tight Buffered.
   e. Cable Fill: Gel-Free .
   f. Maximum Pulling Load: 600 lbs (2700 N).
   g. Operating Temperature Range: -40°C to +70°C.
   h. Parallel Plate Crush Resistance: 1,800 N/cm.
   i. Packaging: Spools/reels, protected from shipment.
   j. Outdoor.
   k. Connectors: SC.

2. Fibers within the cable shall be color-coded so that each fiber may be individually identified. The color sequence suggested is as follows: blue, orange, green, brown, slate, white, red, black, yellow and violet. Dashed versions of the same colors may be used to continue the sequence, depending on the cable structure and fiber count.

3. The outer jackets of the cable shall be continuous, free from holes, splits, blisters or inclusions. The same requirement holds for any inner jackets within a given cable structure as well as for fiber coatings.

4. Materials used for fiber optic cable shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards or applicable federal or state laws or regulations.

5. The color of the polyethylene outer jacket material shall be black in accordance with ASTM D1248, and contain a suitable antioxidant substance. The carbon black used shall be furnace-type conforming to designation N 110 in accordance with the requirements of ASTM D1765. The carbon black content in the jacket material when measured in accordance with the requirements of ASTM D1603 shall be 2.6% ±0.25% by weight. The light absorption coefficient of the jacket material shall be at least 400 when measured at a wavelength of 375 nm in accordance with the requirements of ASTM D3349.

    a. Outer polyethylene jacket materials shall meet tensile strength and elongation minimum requirements for unaged and aged samples as follows:

        (1) Tensile Strength at Break: 2,800 psi (Unaged), 2,100 psi (Aged).
        (2) Elongation at Rupture: 400% (Unaged), 375% (Aged).

6. The cable jacket shrinkage test measures the shrinkage or expansion of a cable jacket exposed to temperature aging for a specified period of time. Maximum shrinkage shall be less than 5% for each specimen tested. The test procedure is described in EIA-RS-455, FOTP-86.

B. Cable Packaging

1. The cable shall be permanently marked to identify the manufacturer, date of manufacture, length markings, a product identification code, and UL messages, where appropriate. The markings shall be printed at regular intervals of not more than 2 feet apart.

2. The cable shall be packaged on a reel with inner hub diameter greater than the recommended minimum bending diameter of the cable. The anchor holes on the reels shall admit a 2-1/2-inch-diameter spindle without binding. The package shall be sturdy enough to endure reasonable handling in the process of shipping and storage. The package shall bear the name of the manufacturer, the product identification code and the total amount of product on the reel.

3. The following information shall be securely attached to the reel as a tag or clearly and permanently stenciled or labeled on each reel:

    a. Customer Order Number.
    b. Customer Job Number.

c. Customer Reel Number.
d. Termination.
e. Ship Date.
f. Manufacturer's Name.
g. Factory Reel Number.
h. Manufacturer's Cable Code (Type and Fiber count).
i. Length of Cable.
j. Weight of Cable and Reel.
k. Defect Tag.

4. The ends of all cable shall be sealed to prevent the escape of filling compound and to prevent the entry of moisture during shipping, handling, storage and installation.

C. Additional Fiber

1. The fiber count of the cable shall be 12, 24 or 72 fibers, as specified above. Each fiber will be tested at the completion of cable installation to verify that there are, indeed, 12, 24, 72 fibers, which conforms to these Specifications.
2. The Contractor may, at their own expense, furnish a cable with more than the specified numbers of fibers to allow for accidental fibers damaged during installation.

D. Fiber Optic Cable Manufacturer

1. Manufacturers: Provide products of one of the following:

a. Corning
b. Lucent.
c. Or equal.

E. Manufacturer Test Documentation

1. Test documentation from the fiber optic cable manufacturer shall be delivered to the Engineer upon delivery of the cable to the Site, as a prerequisite for cable installation.
2. The documentation shall include Optical Time Domain Reflectometer (OTDR) traces for each fiber of each reel at 850 nm and 1,300 nm. Optical attenuation test data shall be furnished for each fiber of each reel, as measured at 850 nm and 1,300 nm.

F. Pre-Installation Testing

1. The Contractor shall test the fiber optic cable prior to its installation. This testing shall be witnessed by the Engineer.
2. Testing shall consist of making an OTDR trace of each fiber of each reel, at both 850 nm and 1,300 nm. The test shall incorporate a one km long backscatter suppression cable inserted between the OTDR and the fiber end. Each trace shall include the optical length and average attenuation.
3. The results of the testing shall be submitted to the ENGINEER prior to installation. Any cable that shows "out-of-spec" performance shall be replaced, at no additional cost to the Owner or delay to the Project Schedule.

G. Cable Termination Enclosure and Hardware

1. Cable termination enclosures shall be furnished and installed at each site accessed by fiber optic cable. The enclosures shall be used to terminate each fiber of the cable.
2. The enclosures/cabinets shall be the 19-inch EIA rack mounted type having provisions for terminating multiple fiber optic cables. Splice trays, strain relief cable attachment points, fiber organizers and bend radius hardware shall be furnished within each termination cabinet. The cabinets shall be furnished with an integral lock to prevent unauthorized entry. All locks shall be keyed identically, two keys shall be furnished for each cabinet installed.
3. The enclosure cabinets shall house a patch panel internally. The patch panel shall swing out for ease of use. Panel size shall be suited to the number of fibers in the cable, for both directions. Bayonet/flanged couplings shall be furnished and mounted for each fiber to be terminated.
4. The termination enclosure shall have a swing-down front door that provides access to all splice trays and patch panels. They shall be sized to accept 12, 24, or 72 fiber cables and provide space for unstripped, coiled cable, each being up to 25 feet long.
5. The cable termination enclosures and hardware shall be manufactured by Corning, Ditel, or equal.

H. Pigtail Cables And Connectors

1. Each of the fibers shall be terminated by splicing pigtails in the termination enclosures.
2. Pigtails shall be 9 feet long. They shall be single mode for operation at 850 nm and 1,300 nm, loose-buffered and manufactured from fiber meeting these Specifications described for the main cable.
3. All connectors shall be identical. They shall be SC-Type, or equal.

I. Splicing

1. The Contractor shall field splice each fiber to a pigtail cable at the termination enclosures. All splices shall be made by the fusion process and shall have a splice loss no greater than 0.35 dB. Loss measurement shall be performed at the time of splicing and documentation shall be furnished for each splice. Splice testing shall be witnessed by the Engineer.
2. Prior to stripping the cable, the Contractor shall record the cable length from the cable jacket. This length shall be documented and included in the test documentation, specified elsewhere.

PART 3 EXECUTION

A. Cable Installation

1. All fiber optic cable shall be installed, terminated, and tested by the fiber subcontractor specified above.
2. In pulling the cable, strain-release, or other tension limiting devices shall be used to limit the pull tension to less than 600 pounds. The Engineer shall witness the cable being pulled.
3. Minimum bend radius restrictions shall be satisfied both during and after cable installation.
4. All conduit and cabinet entrances shall be sealed with RTV or other re-enterable sealant material to prevent ingress of water, dust or other foreign materials.
5. Splices in the fiber optic cable shall only be made at termination points where connectorized pigtails are applied. Non-terminating field splices shall not be made, unless authorized by the Engineer, in writing. If a field splice is required, it shall be fusion spliced and placed in a buried pull box. Closures shall be AT&T UCB1 with Type 2000 outer case, ATL, Corning (Siecor) SCF, or equal. Encapsulant shall be placed between inner and outer closures. Such splices shall meet the loss parameters/testing requirements specified elsewhere.
6. The ends of all cable shall be sealed to prevent the escape of filling compound and to prevent the entry of moisture during installation.
7. At each well site pull box provide an additional 30 feet of fiber cable and rack on cable loop managers.
8. Provide a minimum of 3 feet separation between the fiber conduit and any water or drain piping.
9. Provide a warning tape a minimum of 3 feet above the fiber conduit and location wire.
10. All fiber conduit ells shall be long radius.

11. At each splice box provide fiber closures installed and made ready for future cable splices.
12. Coordinate network connections related to any outages with the County.

B. Cable Damage During Installation

1. If the cable becomes damaged during installation, the Contractor shall stop their operations and notify the Engineer, in writing, immediately. The Owner and Engineer will decide whether to replace the entire reel of cable or to install a splice at the damaged section.
2. If the Owner decides to replace the entire reel of cable, the Contractor shall begin the installation at the last designated splice point. The damaged cable between these points shall be removed, coiled, tagged, and given to the Owner. Installation of new cable to replace damaged cable shall not be a basis of extra payment or Contract completion time. In addition to installation of the new cable, the Contractor shall reimburse the Owner and entire cost of the replacement reel of cable. This cost will be withheld from the Contract price.
3. If the Owner decides to install a splice at the damaged point, and the cable is damaged a second time, the entire reel of damaged cable (and all subsequent damaged reels) shall be replaced with new reels at the Contractor's expense.

C. Cable Acceptance Testing

1. Acceptance testing of the data highway (fiber and electronic equipment) shall be conducted as a part of integrated system field-testing. Prior to such tests, however, the fiber optic cable shall be tested as specified herein.

2. The fiber subcontractor shall retain the services of an independent fiber optic cable testing agent to test the cable and certify the installation. All testing shall be witnessed by the Engineer and Owner. A test plan shall be submitted at least one week prior to the proposed test date(s). The test plan and procedures shall be mutually agreed upon prior to conducting the tests.

3. Each optical fiber in every span shall be tested after installation and termination. For each fiber, an OTDR trace hardcopy is required. This end-to-end trace shall be performed from BOTH ends of the fiber. The traces shall be made at 850 nm and 1300 nm. Also for each fiber, and end-to-end power attenuation (insertion loss) test shall be performed from BOTH ends of the fiber. The attenuation test shall use a stabilized optical

source and an optical power meter calibrated to the appropriate operating wavelength (850 nm and 1,300 nm).

4. For each installed fiber, the power attenuation shall not exceed the following, tested from connector to connector at the respective patch panels, at 850 nm and 1,300 nm. For the 1,300 nm test, substitute 0.0020 for 0.0035 in the first term of the equation.

   $(0.0035)L + (0.35)N + 3.0$ dB

   where L = the length of the fiber in meters.
   N = the number of fusion splices in the fiber.

5. Any fiber optic cables containing one or more fibers not meeting this performance will not be accepted by the Owner, and shall be repaired or replaced at no additional cost to the Owner.

6. All fiber optic testing shall be documented on pre-approved test forms. Three copies of all documents (including OTDR traces) shall be submitted to the Engineer upon successful completion of the testing.

7. Work at the termination cabinets shall be performed such that the fiber optic cables, and the fibers, are not subjected to undesirable bending both during the Work and when permanently fixed in place. The cables, fibers, pigtails, etc. shall be organized in a neat and orderly fashion within the enclosure. Inspection of the Work shall be performed by the Engineer. Unsatisfactory Work shall be reworked.

END OF SECTION

SECTION 13070
PANEL MOUNTED INSTRUMENTS AND DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. The Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust, and place into satisfactory operation panel instruments and devices.
2. Contract Documents illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, piping, and accessories required to make a completely integrated system. The Contractor shall provide all piping, wiring, accessories, and labor required for a complete, workable, and integrated system.

B. Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

1.02 QUALITY ASSURANCE

A. Comply with the requirements of Section 13600, Process Control System General Provisions.

B. Acceptable Manufacturers

1. Furnish instruments and devices by the named manufacturers or equal equipment by other manufacturers.
2. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
3. Obtain all instruments or devices of a given type from the same manufacturer.

C. Manufacturers' Responsibilities and Services

1. Design and manufacture the instruments and devices in accordance with the applicable general design requirements specified in Section 13600,

Process Control System General Provisions, and the detailed Specifications herein.

1.03 SUBMITTALS

A. Comply with the requirements of Section 13600, Process Control System General Provisions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with the requirements specified in Section 13600, Process Control System General Provisions.

B. Instruments and devices shall not be assembled in the panels until all product information and system Shop Drawings for respective components have been approved.

1.05 IDENTIFICATION TAGS

A. All panel instruments and devices shall have an identification tag meeting the following requirements:

1. Tag numbers shall be as listed in the Instrument Index.
2. Identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self-tapping screws of appropriate size.
3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch-diameter stainless steel wire rope.
4. All instruments and devices mounted within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.
5. Front of panel mounted components shall have nameplates, which comply with the requirements specified in Section 13090, Process Controls Panels and Hardware.

PART 2 PRODUCTS

2.01 POWER SUPPLIES

A. General: Single unit and multiple unit power supplies, located in control room panels, remote terminal units and field panels as required.

B. Single Unit Required Features:

1. Solid state circuitry.
2. Surface mounting.
3. Input Power: 120 VAC ±10%, 60 Hz.
4. Output Power: 24 VDC or as required.
5. Line/Load Regulation: ±0.005%.
6. Ripple: 0.25 mV RMS.
7. Polarity: Floating output.
8. Ambient Temperature: -20°C to +71°C.
9. Response Time: <20µS.
10. Overload Protection: Internal preset.
11. Include mounting brackets, fuse, and mating connector for AC power plug.
12. UL 508 listed.
13. Failover discrete signal monitoring capability to be provided at SCADA for all power supplies within each control panel.

C. Products and Manufacturers: Provide one of the following:

1. Phoenix Quint.

2.02 UNINTERRUPTIBLE POWER SYSTEM

A. Ambient

1. Degree of protection: IP20.
2. Inflammability class in accordance with UL 94 (housing/terminal blocks): V0.
3. Ambient temperature (operation): -25 °C to 70 °C (> 60 °C Derating: 2,5 %/K).
4. Ambient temperature (start-up type tested): -40 °C.
5. Ambient temperature (storage/transport): -40 °C to 85 °C.
6. Max. permissible relative humidity (operation): ≤ 95 % (at 25 °C, non-condensing).
7. Climatic class: 3K3 (in accordance with EN 60721).
8. Degree of pollution: 2.
9. Installation height: ≤ 5000 m (> 2000 m, observe derating).

B. General

1. Efficiency:

   a. Typically 93.9% (400 V AC).
   b. Typically 93.8% (480 V AC).

2. MTBF (IEC 61709, SN 29500):

   a. > 985,000 h (25 °C).
   b. > 638,000 h (40 °C).
   c. > 311,000 h (60 °C).

3. Insulation voltage input/output:

   a. 4 kV AC (type test).
   b. 2.4 kV AC (routine test).

4. Insulation voltage input/PE:

   a. 3.5 kV AC (type test).
   b. 2.4 kV AC (routine test).

5. Insulation voltage output/PE:

   a. 0.5 kV DC (type test).
   b. 0.5 kV DC (routine test).

6. Degree of protection: IP20.

7. Protection class: I.

8. Inflammability class in accordance with UL 94 (housing/terminal blocks): V0.

9. Mounting position: Horizontal DIN rail NS 35, EN 60715.

C. Approvals

1. UL approvals UL Listed UL 508.
2. UL/C-UL Recognized UL 60950-1.
3. UL ANSI/ISA-12.12.01 Class I, Division 2, Groups A, B, C, D (Hazardous Location).

D. Manufacturer

1. Phoenix Contact Quint.

2.03 SELECTOR SWITCHES, PUSHBUTTONS, AND INDICATING LIGHTS

A. General

1. Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type for all the panels provided in this Contract. Equipment Suppliers shall coordinate with the Contractor to provide same series or model type of switches, pushbuttons and indicating lights.

2. Type:

a. Heavy duty, oil tight.

3. Provide legend plate for indication of switch, pushbutton or light function (e.g., "OPEN-CLOSED", "HAND-OFF-AUTO").

4. Mounting: Flush mounted on control panel front, unless otherwise noted.

5. NEMA rated to match panel in which mounted.

B. Selector Switches

1. Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.

2. Contacts:

a. Provide number and arrangement of contacts as required to perform intended functions specified, but not less than one single pole, double throw contact.
b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts, but not less than 10 A resistive at 120 VAC or DC continuous.

3. Switch Operator: Standard black knob.

C. Pushbuttons (Standard or Illuminated)

1. Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.
2. Contacts: Comply with the requirements specified for selector switches.

D. Indicating Lights

1. Type: Compact, integral transformer type.
2. Lamps: 6-volt, long-life (20,000 hours minimum).
3. Common: Push to test circuitry or Push-To-Test lamps shall be provided for each panel to simultaneously test all indicating lights on the panel using a single pushbutton.

E. Button and Lens Colors

1. Green for indication of open, on, running.
2. Red for indication of closed, off (ready), stopped.
3. Amber for indication of equipment malfunction, process trouble and alarms (e.g., "HIGH LEVEL", "LOW LEVEL", etc.).
4. Blue for indication of electrical control power on.

F. Rotary Cam Switches

1. Provide rotary cam switches with number of positions and poles as required to perform the required signal switching function specified and shown.

2. Contacts:

    a. Gold-flashed contacts housed in mechanical contact blocks with number and arrangement of contacts as required to perform intended functions.
    b. Contact Rating: Compatible with AC or DC through-put current of signals and devices simultaneously operated by the switch contacts, but not less than 20 A at 600 VAC or 250 VDC continuous.

3. Switch Operator: Standard black knob.

G. Products and Manufacturers: Provide one of the following:

1. Cutler-Hammer, Type E30.
2. Allen Bradley, Series 800H.
3. Or approved equal.

H. Operator-Indicator Units

1. All operators and indicators shall conform to the following:

   a. Type: CMC units as manufactured by Micro Switch.
   b. Rating: Oil-tight, heavy duty.
   c. Indication: Maximum four quadrant displays with individual lamp.
   d. Lamp Voltage: 6 volts.
   e. Color: Black bezel and knob.

2. Indicator Light Modules:

   a. Use: Equipment status (e.g., "ON/OFF", "OPEN/CLOSED").

   b. Color Coding and Legends:

Quadrant	Color	Legend
A	GREEN	Off; Closed; No-Flow
B	RED	On; Open; Flow
C&D	WHITE	(Equipment Name)

3. "Three Position" Selector Switch Modules:

   a. Use: For manual or automatic operation of equipment (e.g., pumps, gates).

   b. Type: Three-position maintained contact type.

c. Color Coding and Legends:

Quadrant	Color	Legend
A	RED	Hand; Open
B	GREEN	Off; Closed
C	GREEN	Auto
D	WHITE	(Equipment Name)

(1) Red or green quadrant lights shall be energized depending on selected position of the switch. White quadrant light shall be energized continuously.

4. "Two Position" Selector Switch:

a. Use: To select equipment mode (e.g., winter/summer; pumps 1/2).

b. Type: Two-position maintained contact type.

c. Color Coding and Legends:

Quadrant	Color	Legend
A	BLUE	(Mode)
B	GREEN	(Mode)
C&D	WHITE	(Function)

(1) Blue or green quadrant light shall be energized depending on selected position of the switch. White quadrant light shall be energized continuously.

5. "Alarm Acknowledge" Pushbutton:

a. Use: To silence audible device associated with annunciator.

b. Type: Momentary pushbutton action.

c. Color Coding and Legends:

Quadrant	Color	Legend
A&B	AMBER	Alarm
C&D	AMBER	Acknowledge

d. Lights: None.

6. "Annunciator Test" Pushbutton:

a. Use: To functionally test the annunciator regarding lights and audible device.

b. Type: Momentary pushbutton action.

c. Color Coding and Legends:

Quadrant	Color	Legend
A&B	AMBER	Annunciator
C&D	AMBER	Test

d. Lights: None.

2.04 DIGITAL INDICATOR

A. General: The digital indicator shall accept an analog input and convert it to scaled numerical characters for digital display and also provide up to two alarm outputs.

B. Required Features:

1. Display Height: 0.56-inch.
2. Display Capacity: Four digits with decimal point position jumper selectable.
3. Display Type: Seven segment, red LED.
4. Accuracy: ± 0.05%.
5. Analog Input: 4 to 20 mADC.
6. Excitation Output: 15 VDC for powering transmitter.
7. Analog Output: Proportional 4 to 20 mADC.
8. Alarm Output: Dual with two 2 A relays.
9. Temperature Range: 0°C to 60°C.
10. Power: 120 VAC, + 10 to 15%, 5 watts.
11. Enclosure: NEMA 4 splashproof.

C. Products and Manufacturers: Provide one of the following:

1. Newport Electronics, Model Q9000E.
2. Precision Digital, Model PD690.
3. Or approved equal.

2.05 ANALOG INDICATOR

A. General: Indicator Unit shall be a signal monitoring instrument that provides continuous monitoring of a process variable on a scaled vertical bar display. Indicator shall match in appearance other panel mounted instruments.

B. Description: Indicator Unit shall display one process variable.

C. Required Features:

1. 250 ohm range resistor.

2. Power Required: 21 to 28 VDC; nominal input current at 24 VDC is 400 mA.

3. Displays: One segmented gas-discharge or LED vertical bar display.

4. Display Accuracy: 1% of input span.

5. Scale Length: Approximately 3 inches.

6. Operating Influences:

   a. Ambient Temperature: Maintains display accuracy ratings for temperature change within normal operating conditions.
   b. Supply Voltage: Maintains display accuracy ratings for supply voltage variation between 21 and 28 VDC.
   c. Electromagnetic Interference (EMI): Maintains display accuracy ratings when instrument is subjected to an electromagnetic field of up to ten volts/meter (when rack-mounted in cabinet with door closed). Display station must be installed in panel.

7. Operating Conditions:

   a. Ambient Temperature: 41 to 122°F (5 to 50°C).
   b. Maximum Temperature Variation: 36°F per hour (20°C per hour).
   c. Ambient Relative Humidity: 10 to 90% non-condensing.

8. Mounting: Display station installs in a nominal 1-inch by 6-inch panel cutout and shall match in appearance other panel mounted instruments.

D. Products and Manufacturers: Provide one of the following:

1. OTEK Corporation, Model HI-QSLIM.
2. Ametek/Dixson, Model BE051.
3. Or approved equal.

2.06 CYCLE TIMER

A. Type: Adjustable, microprocessor-based multipurpose timer/counter.

B. Construction Features:

1. Switch selectable ranges as follows:

a. 0 to 0.99 seconds.
b. 0 to 99.9 seconds.
c. 0 to 999 seconds.
d. 0 to 9.99 minutes.
e. 0 to 99.9 minutes.
f. 0 to 999 minutes.
g. 0 to 99.9 hours.
h. 0 to 999 hours.

2. Repeat Accuracy:

a. Timer: ±10 milliseconds (ms) on all ranges.
b. Counter: 100% on all ranges.

3. Memory: Non-volatile memory that will retain entire program and present time/count periods at loss of power; programmable for both reset and non-reset power fail operation.

4. Operating Temperature: 32 to 140°F.

5. Cycle Progress Display: Three-digit display, programmable to run up to or down from the setpoint and to stop or continue up from zero after time-out/count-out.

6. Time/Count Periods: Three programmable presets; pulse, early and main.

7. Load Relays:

   a. Type: DPDT.
   b. Number: One early and one delayed.
   c. Contact Ratings: Seven amps at 120 VAC.

8. Terminals: Screw terminals accessible at rear.

9. Housing: Fully gasketed, dust and watertight.

10. Power Input: 120 VAC.

C. Products and Manufacturers: Provide one of the following:

1. Automatic Timing and Controls Company, Model 365M.
2. Or approved equal.

2.07 ELECTRONIC TOTALIZER AND INTEGRATOR

A. General

1. Electronic integrator shall be a solid-state device to totalize a linear flow signal with respect to time. The integrated output shall be indicated on a front counter, calibrated to read directly in units of flow and shall be mounted on the panel face.

B. Required Features

1. Modular plug-in design.

2. Variable dropout adjustment shall be provided to prevent erroneous counting at low flow rates.

3. Input Signal: 4 to 20 mADC.

4. Power Requirements: 120 VAC ±10%, 60 Hz.

5. Accuracy: 0.5% of rate between 10 and 100% of full scale.

6. Slide-out chassis.

7. Suitable for flush panel mounting.

8. Unit shall match in appearance other panel mounted instruments.

9. Integrator Output Display:

    a. Integrally mounted six or eight-digit LCD.
    b. Non-reset.
    c. Battery backed to prevent loss of display in the event of power outages.

10. Enclosure: NEMA 4X.

11. Ambient Operating Temperature: 0°C to 55°C.

12. Ambient Operating Humidity: 0 to 85% non-condensing.

C. Products and Manufacturers: Provide one of the following:

1. Precision Digital, Model PD692.
2. Or approved equal.

2.08 ELAPSED TIME METER (HOUR METER)

A. General: Unit shall be a powered, non-resettable time indicator, with easy to read analog figures.

B. Required Features

1. Power: 120 VAC, or 4 to 40 VDC.
2. Accuracy: Within 1%.
3. Capacity: Up to 99,999.9 hours (automatic recycle at zero); 1/10-hour resolution.
4. Operating Temperature: -40°C to +68°C.
5. Sealed against dirt and moisture.
6. Tamperproof.
7. Shock resistant.
8. Panel mountable.
9. Nameplate below display shall read "TOTAL HOURS".

C. Products and Manufacturers: Provide one of the following:

1. Dynapar/Veeder-Root, 7795 Series.
2. Cutler-Hammer, E42DIR Series.
3. Or approved equal.

2.09 CONTROL RELAY

A. Type: General purpose, plug-in type rated for continuous duty.

B. Construction Features

1. Coil Voltages: 24 VDC or 120 VAC, as required.

2. Contacts:

a. Silver cadmium oxide rated not less than 5 A resistive at 120 VAC or 24 VDC continuous.
b. For switching low energy circuits (less than 200 mA) fine silver, gold flashed contacts rated not less than 3 A resistive at 120 VAC or 28 VDC continuous shall be provided.

3. Relays to have clear plastic dust cover.

4. Relays to have pilot light to show energized coil.

5. Relays to be UL recognized.

C. Products and Manufacturers: Provide one of the following:

1. Omron.

2.10 TIME DELAY RELAY

A. Type: Dial adjustable, plug-in type time delay relay providing delay-on-make, delay-on-break or interval operation.

B. Construction Features

1. MOS digital circuit with transformer coupled power.

2. Switch selectable ranges as follows:

a. 1 second.
b. 10 seconds.
c. 1 minute.
d. 10 minutes.
e. 1 hour.
f. 10 hours.

3. Minimum Setting: 3% of range, except 50 ms for 1-second range.

4. Setting Knob Accuracy: 10%.

5. Contacts:

   a. Type: DPDT.
   b. Rating: 5 A resistive at 120 VAC, 5 A at 24 VDC.

6. Housing: Plug-in design with dust and moisture resistant molded plastic case.

7. Power Input: 120 VAC or 24 VDC as required.

8. Operating Temperature: 0°C to 55°C.

9. Unit shall have LED to show timing status.

10. Relays to be UL recognized.

C. Products and Manufacturers: Provide one of the following:

1. Automatic Timing and Controls Company, Series 328D.
2. IDEC, Series GE1A.
3. Or approved equal.

2.11 CURRENT ALARM RELAY

A. Type: Direct current, electronic setpoint control relay which accepts 4 to 20 mADC input signal and provides dry circuit contact output based on trip point setting.

B. Performance Requirements

1. Repeatability: Trip point repeats within ±0.2% of span.
2. Trip Adjustment: 0 to 100% of span.
3. Adjustable Deadband: 1 to 15% of span.

C. Construction Features

1. Trip Adjustment: Multi-turn front panel adjustment.
2. Contacts: DPDT relays, rated 5 A at 120 VAC or 24 VDC non-inductive.
3. Enclosure: Standard housing designed for internal panel mounting.
4. Power Supply: 120 VAC, 60 Hz or 24 VDC, as required.

D. Products and Manufacturers: Provide one of the following:

1. Ronan, X54 Series.
2. Action Pak, Model AP 1080.
3. Or approved equal.

2.12 CURRENT ISOLATOR

A. General: The isolating unit shall be a two wire, loop-powered device. It shall accept a 4 to 20 mADC input signal and deliver a 4 to 20 mADC output.

B. Required Features

1. Repeatability: ±1% of span.
2. Ambient Temperature Range: 0°C to 50°C.
3. Ambient Humidity Range: 0 to 95%, non-condensing.
4. Accuracy: 0.5%.
5. Linearity: ±0.1% of full scale.
6. Provide one spare isolator.

C. Products and Manufacturers: Provide one of the following:

1. Ronan, X57 Series.
2. Action Instruments, G408 Series.
3. Crompton Instruments, 250 Series.
4. Or approved equal.

2.13 ADDER

A. General: Computing element shall add the signals as shown. Provide in sufficient quantities to accommodate all signals.

B. Required Features

1. Input/output bias adjustments.
2. Process current inputs and outputs (4 to 20 mADC).
3. Input/output isolation.
4. 120 VAC or 24 VDC power, as required.
5. Linearity: ±0.1% of span.
6. Response Time: Less than 750 ms (10 to 90%).
7. Operating Temperature Range: 0°C to 55°C.
8. Controls: Multi-turn potentiometers for output zero and input span scale factor.

C. Products and Manufacturers: Provide one of the following:

1. Action instruments, Model AP4402.
2. Pribusin Inc., Model IUC-XX-ADD.
3. Or approved equal.

2.14 MULTIPLIER/DIVIDER

A. General: Computing element shall multiply or divide the signals shown. Provide sufficient quantities to accommodate all signals.

B. Required Features

1. Input/output bias adjustments.
2. Process current inputs and outputs (4 to 20 mADC).
3. Input/output isolation.
4. 24 VDC power.
5. Linearity: ±0.15% of span.
6. Operating Temperature: 0°C to 55°C.

C. Products and Manufacturers: Provide one of the following:

1. Action Instruments, Model Q498.
2. Or approved equal.

2.15 ELECTRONIC SQUARE ROOT EXTRACTOR

A. General: Electronic square root extractor shall provide a current signal output that is the square root of the input signal.

B. Required Features

1. Input Signal: 4 to 20 mADC.
2. Output Signal: 4 to 20 mADC.
3. Adjustable Zero Dropout.
4. Accuracy: 0.25% of span.
5. Response Time: 70 ms.
6. Operating Temperature: -10°C to 60°C.

C. Products and Manufacturers: Provide one of the following:

1. API, Model 4440G.
2. Or approved equal.

2.16 CURRENT AND VOLTAGE TRANSDUCER

A. General: Transducer shall convert a sinusoidal alternating current or voltage into a DC current output, proportional to the RMS value of input.

B. Required Features

1. Inputs: 50/60 Hz:

   a. Current: 1A or 5A current transformer secondaries.
   b. Voltage: 50 to 480 VAC.

2. Output: 4 to 20 mADC into 0 to 500 Ohms.

3. Zero adjustment: ±2% minimum.

4. Span adjustment: ±10% minimum.

5. Accuracy: ±0.5%.

6. Response time: ≤ 400 ms. to 99% rated output.

7. Operating Temperature: 0°C to 50°C.

8. Operating Humidity: 0 to 95% non-condensing

9. Output Protection: Fully protected against open or short circuit outputs.

10. Overload Capacity: Two times rated current of 1.25 times rated voltage on a continuous basis.

11. Surge Withstand: Conform to ANSI C37-90a.

C. Products and Manufacturers: Provide one of the following:

1. Crompton Instruments, 250 Series.
2. Ametek, Exceltronic II Series.
3. Or approved equal.

2.17 WATT TRANSDUCER

A. General: Measure active power, in both balanced and unbalanced, single- or three-phase systems.

B. Required Features

1. Frequency: 60 Hz.
2. Voltage: 50 to 480 volts with ±20% range and 2 volt-ampere (va) maximum burden.
3. Current: 1A or 5A current transformer secondaries with 0 to 125% range and 1 va maximum border.
4. Output: 4 to 20 mADC in 0 to 500 ohms.
5. Supply: 120 VAC.
6. Accuracy: 0.5%.
7. Response Time: Less than 400 msec up 99% rated output.
8. Output Protection: Fully protected against open or short-circuited output.

C. Products and Manufacturers: Provide one of the following:

1. Crompton Instruments, 250 Series.
2. Or approved equal.

2.18 MANUAL LOADING STATION

A. General: Manual-loading station (signal generator) shall be fully suitable for flush panel mounting.

B. Features

1. Outputs: Two independent 4 to 20 mADC.
2. Horizontal or vertical indicator length (reading station output): 1-1/2 inches minimum.
3. Graduations of Indicator: 0 to 100%.
4. Output Adjustment: Front panel pushbuttons.
5. Supply Voltage: 120 VAC or 24 VDC, as required.
6. Accuracy: ±0.2% of span.
7. Load Resistance: 0 to 750 ohms.
8. Sampling Rate: 50 ms.
9. Operating Temperature: 4°C to 52°C.
10. Operating Humidity: 10 to 90% non-condensing.
11. Overall Length of Unit: Shall not exceed 15 inches in length.
12. Station case shall be constructed of steel and the chassis shall be constructed of non-corrosive metallic material. Bezel shall be finished in a gray enamel finish.

C. Products and Manufacturers: Provide one of the following:

1. ABB, Model 53ML5100.
2. Or approved equal.

2.19 OPERATOR INTERFACE (OIT)

A. General: 10-Inch Color Touchscreen Operator Interface

1. POWER: +24 VDC ±20%.
2. 10-Inch SVGA Color High-Resolution Touchscreen HMI (800 x 600).
3. Ethernet Ports: One 10/100 Base-TX.
4. Serial Ports: Two RS-232 and One RS-422/485.
5. One USB Type B Port.
6. NEMA Rating: NEMA 4X.
7. Panel Mounting.
8. SD Card Memory.
9. Operating Temperature: -20°C to 60°C (-4°F to 140°F).

B. Manufacturer

1. Red Lion G10R0000.

2.20 ETHERNET/ NETWORK SWITCH

A. General: Furnish and install fiber-optic modular, managed Ethernet switches for connecting devices on the network. The use of hubs will not be permitted.

B. Features

1. 10/100/1000 base-T, auto-negotiation 802.3u.
2. Minimum of eight RJ-45 ports. Ethernet ports shall be expanded as needed to interconnect all system components and shall support 10gb.
3. Minimum of two fiber optic ports for one fiber pair. Fiber optic ports shall be expanded as needed to interconnect all system components.
4. Supports the use of IGMP for multicast traffic.
5. Supports VLAN as defined in IEE802.1Q.
6. Supports the use of SNMP management.
7. LED for indicating port status.
8. Internal Panel mounting kit.
9. Failsafe output relay to indicate malfunction with unit.
10. FCC Part 15, Class A compliant.

11. Provide management software for multilevel security, web based configuration and remote monitoring.
12. Powered by circuit on Uninterruptible Power Supply.

C. Product and Manufacturer

1. N-TRON Rack mounted.

2.21 FIBER-TO-COPPER MEDIA CONVERTERS

A. Fiber optic converters shall convert Ethernet TCP/IP network data to a format suitable for transmission over multi-mode fiber optic cable.

B. Features: Converters shall provide:

1. Full-duplex 100M/1000Gbps Ethernet operation.
2. Single mode fiber optic media support.
3. Remote and local interface status.

C. Provide suitable transformers to convert 120VAC power to appropriate voltage necessary to provide power to Transceivers.

D. For control panel mounting, converter shall be DIN-rail mountable.

E. Product and Manufacturer

1. N-TRON.

2.22 FIBER OPTIC PATCH PANELS (FOPP)

A. General: Fiber optic patch panels shall be furnished as required to house fiber optic cable terminations and any other data highway attached equipment.

B. The cabinets shall meet the following requirements:

1. The termination cabinet shall be the rack mounted type, having provisions for terminating multiple fiber optic cables. Splice trays, strain relief cable attachment points, fiber organizers and bend radius hardware shall be furnished with each termination cabinet.
2. Patch Panel size shall be suited to the number of fibers to be terminated within the cabinet. Bayonet/flanged couplings shall be furnished and mounted for each fiber to be terminated.

3. Fiber terminations shall be spliced to pigtail cables using ST connectors (unless indicated otherwise). The pigtails shall be terminated in an orderly method.
4. All fibers shall have connectors installed and terminated on patch panels.

2.23 AUTODIALER

A. Wireless real-time

1. Cellular Communication.

2. Software for remote PC running Windows.

3. Managed Service.

4. 120VAC with backup battery power.

5. Provide a 1-year monitoring service with Mission Communications.

6. The following will be monitored:

   a. GSR High Level.
   b. GSR Low Level.
   c. Low Pressure Alarm.
   d. High Pressure Alarm.

7. Manufacturer:

   a. Mission Communication MyDro 852.

2.24 STRIP CHART RECORDERS

A. Standard Specifications

1. Compact recorder with a recording width of 100mm.
2. Flush Panel Mounting (vertical), mounting next to each other (horizontal and vertical).
3. Recording Period: dot matrix model, continuous for each channel.
4. Chart Speed: 1 to 1,500mm/h (1mm step).
5. Periodic printout contents: Date (mm/dd/yy), time (hh:mm), measurement data of each channel , scale printout, recording color, chart speed.
6. Colors: ch1=purple, ch2=red, ch3=green, ch4=blue, ch5=brown, ch6=black (color can be assigned to any channel).

B. Manufacturer

1. Yokogawa: uR10000.

2.25 SPARE PARTS AND TEST EQUIPMENT

A. The Contractor shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Section.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. The following shall constitute the minimum spare parts:

1. Five of each type of input-output relay for each 40 or less furnished for this Contract.
2. One replacement power supply for each type and size furnished for this Contract.
3. A 1-year supply of all expendable materials.
4. One per ten (two, if fewer than twenty) of each type of panel mounted instrument including lights, and pushbuttons.
5. One dozen of each type and size of fuse used in panels and instruments.

D. The following shall constitute the minimum test and calibration equipment:

1. Two signal simulators (4 to 20 mADC; 1 to 5 VDC), including cases. Altek 334A Simulators shall be battery powered and shall include charger.

E. All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.

F. For analog instruments, the supplier shall submit a separate quotation for a recommended list of spare-parts and test equipment. Each item recommended shall be listed and priced separately. The spare parts quotation shall contain a statement that the prices quoted are firm for a period of one year (with escalators for the next two years) subsequent to the Owner's acceptance of the equipment, and that the supplier understands that the Owner reserves the right to purchase none, any, or all of the parts quoted. The supplier is required to show that a stock of spare-parts and test equipment is obtainable within a 48-hour period.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install each item in accordance with manufacturers' recommendations and in accordance with the Contract Documents.

B. All items shall be mounted and anchored in compliance with Section 13090, Process Control Panels and Hardware.

END OF SECTION

SECTION 13080
PRIMARY SENSORS AND FIELD INSTRUMENTS

PART 1 GENERAL

1.01 SCOPE

A. This Section covers the furnishing of all instrumentation equipment required for the PICS as indicated on the Drawings and as required.

B. Principal components of the instrumentation systems shall be as indicated on the P&ID drawings; as indicated on the instrument device schedules either attached to this Section or at the end of Section 13080, Primary Sensors and Field Instruments.

C. Instruments shown in these sections are required to be provided by the Contractor or PICS Supplier, but may be provided for future use as specifically designated.

D. Terminology: When the phrase "as required" is stated in this Section it shall mean "as required in any attached Data Sheet(s)" or shown on the Drawings.

1.02 GENERAL

A. The PICS Supplier shall select the equipment furnished under this Section for its superior quality and the intended performance. The Contractor or PICS Supplier shall install all equipment in accordance with the manufacturer's instructions. Equipment and materials used shall be subject to review and shall comply with the following requirements.

1. General Equipment Requirements: When required, the General Equipment Requirements shall apply to all equipment provided under this Section.

2. Drawings: Supplementing this Section, the drawings indicate locations and arrangement of instruments and enclosures, provide mounting details, and may show device schedules and other information regarding the connection and interaction with other equipment.

3. Corrosive Fluids: All parts, which are exposed to corrosive conditions, shall be made from corrosion resistant materials. The Contractor shall submit certification that the instrument manufacturer approves the selection of materials of primary elements which are in contact with the specified process fluid to be inert to the effects of the process fluid.

4. Elevation and Temperature: All instruments shall be designed to operate within an elevation range of 1,000 feet above sea level and temperature range of 0 to 104 degrees Fahrenheit. Provide heaters, pipe heat tracing, air conditioning, and equipment enclosures and sub shields as required.

5. Power and Instrument Signals: Unless otherwise indicated, electric power supply to the instrumentation equipment will be unregulated 120 volts ac. Unless otherwise indicated, all transmitted electronic analog instrument signals shall be 4-20 mA dc and shall be linear with the measured variable.

6. Appurtenances: Signal converters, signal boosters, amplifiers, special power supplies, special cable, special grounding, calibration manifolds, isolation valves, and electronic isolation devices shall be furnished as needed for proper performance of the equipment. All field power supplies shall be redundant with bumpless transfer in the event of a failure.

    a. Provide control panel signal isolators for all analog signals.

    b. Provide surge suppression for all analog signals both at the transmitter and control panel termination.

    c. Provide manufacturer's stainless steel calibration manifolds for transmitters.

    d. Provide manufacturer's recommended stainless steel mounting brackets and hardware.

    e. Provide all instruments with Hart communications if available.

        (1) Field Mounted Transmitter Analog Surge Protectors: All analog input and output circuits shall be protected at both the panel and field ends with surge protection. Field (at instrument) surge protectors shall provide line-to line and line-to-ground protection. The suppression circuit shall be a multistage hybrid device utilizing surge arresting diodes and gas discharge tubes.

Nominal Voltage	24 VDC	
Max. Operating Voltage	28 VDC	
Max. Operating Current	250 mA	
Nominal Discharge Current	Normal Mode	10 kA

(8 x 20 uS Waveform)	Common Mode	10 kA
Response Time	Normal Mode	1 nSec
	Common Mode	100 nSec
Series Resistance	10 ohm	
Pipe Nipple	Material	304 SS
	Thread	3/4-inch NPT
	Length 4-inch	

The surge suppressor shall be a Phoenix Contact PipeTrab Model S-PT1-2PE-24DC without exception for compatibility with existing installations.

(2) Four Wire Field Mounted Transmitter Surge Protectors: All four-wire transmitters (120 VAC plus 4 to 20 ma) that are not UPS powered and/or are located outside of the building housing the monitoring PLC shall have power and signal surge protection at the transmitter. Refer to electrical drawings for exceptions. The surge protector is a single hybrid unit contained in a NEMA 4X polycarbonate case. Field wiring is terminated with quick disconnect or barrier terminal strips.

AC Input Voltage	120 VAC, 60 Hz, with LED indicator
AC Max. Output Current	15 Amps fused
AC Surge Protection	Technology: Three-Stage Series Hybrid
	Max. Surge Amps (8x20 uS): 10 kA
	Response Time: < nanoseconds
DC Signal Protection	Technology: Series Hybrid
	Peal Surge Amps: 10 kA
	Response Time: < nanosecond
	Voltage Clamp: 8 to 200 Volts Selectable
DC Resistance	5 Ohms Typical
Nominal Outside Dimensions-Polycarbonate Case	6.9 inches high x 6.9 inches wide x 3 inches deep

The surge suppressor shall be an EDCO SLAC series.

7. Interchangeability and Appearance: To the extent possible, instruments used for similar types of functions and services shall be of the same brand and model line. Similar components of different instruments shall be the products of the same manufacturer to facilitate maintenance and stocking of repair parts. Whenever possible, identical units shall be furnished. Where devices have standardized by the Owner, no substitutions shall be allowed.

PART 2 PRODUCTS

2.01 FIELD MOUNTED PRESSURE GAUGES

A. Pressure gauges shall be of the indicating dial type, with C-type phosphor bronze Bourdon tube; stainless steel rotary geared movement; phenolic or polypropylene open front turret case; adjustable pointer; stainless steel, phenolic, or polypropylene ring; and shatterproof glass window.

B. Gauge dial shall be 4-1/2 inch size, with white background and black markings. The units of measurement shall be indicated on the dial face. Subdivisions of the scale shall conform to the requirements of the governing standard. Pointer travel shall be not less than 200 degrees or more than 270 degrees of arc.

C. Surface-mounted gauges shall be provided with 1/4 inch NPT connections. All stem-mounted gauges shall be provided with 1/2 inch NPT connections. Where indicated in the drawings or on the Instrument Device Schedule, stem mounted gauges shall have an adjustable viewing angle to allow the gauge to be positioned for optimum viewing.

D. All pressure gauges shall measure in psi and all vacuum gauges in inches water. All gauges shall have a suitable range to give mid-scale readings under normal conditions. Gauge accuracy shall be 0.5% of scale range.

E. Each gauge shall be provided with a threaded end, ball-type gauge valve. Gauge valve materials shall be compatible with the measured process. Where the process is not defined, gauge valves shall have AISI Type 316 stainless steel wetted parts and Teflon seals. Multi-port gauge valves shall have all unused ports plugged.

F. Where indicated on the drawings or the Instrument Device Schedule, the pressure gauge shall be provided with a pressure snubber. Each snubber shall be of a size and pressure range compatible with the gauge served. Snubbers shall be Ashcroft "Pulsation Dampers", or approved equal.

G. Where indicated on the drawings or in the Instrument Device Schedule, a diaphragm seal shall be provided for the respective gauge. Diaphragm seals shall

be thread-attached type with removable AISI Type 316 stainless steel diaphragm, zinc or cadmium plated carbon steel upper housing, and stainless steel lower housing. The upper housing shall be contoured to fit and provide a seat and seal for the diaphragm and shall be designed to permit removal of the gauge with the system under pressure. The lower housing shall be provided with a tapped and plugged 1/4 inch NPT flushing connection. Each diaphragm seal and the gauge served shall be factory assembled, filled with a suitable fluid, and calibrated as a unit.

H. Gauges shall be installed at the locations indicated on the drawings, with installation conforming to the installation details. All gauges, snubbers, and diaphragm seals shall be installed in the vertical, upright position. Thread sealer, suitable for use with the associated process, shall be used in the assembly of threaded connections. All connections shall be free from leaks. Lines shall be purged of trapped air at gauge locations prior to installation of the gauge or diaphragm seal.

I. Each gauge shall be provided with all required mounting hardware to securely mount the unit according to the mounting requirements indicated in the drawings or the Instrument Device Schedule.

J. Unless otherwise indicated, mounting and installation hardware shall be Type 316L stainless steel.

K. Pressure gauges shall be WIKA or Engineer- and Owner-approved equal.

2.02 DIAPHRAGM SEAL

A. General

1. Furnish diaphragm seals for pressure gauges and switches at locations shown and as specified.
2. The complete diaphragm seal assembly, including gage, switch or transmitter, shall be factory assembled, filled and calibrated to the ranges and switch setpoints specified prior to shipment.
3. System Supplier Manufacturer shall be responsible for assuring that fill volumes and sensitivities of the supplied seals and diaphragms are suitable to provide the required gage, switch or transmitter accuracy over the specified measurement range or at switch setpoints.
4. Location and orientation of the gauges, switches and seal assemblies shall be coordinated with the actual piping and equipment installations so that gages and indicators shall be easily read and accessed for maintenance by plant personnel.

5. Where field mounting and orientation conflicts arise due to incomplete coordination with field changes in the process piping and equipment installation, assemblies shall be relocated, re-oriented, re-assembled and re-calibrated as directed by the Engineer.

B. Construction Features

1. Instrument Connection: 1/4-inch NPT:

a. Process Connection: 1/2-inch NPT.

b. Flushing Connection: 1/4-inch NPT.

c. Top Housing Materials: Type 316 stainless steel.

d. Process Side Housing Materials:

(1) Type 316L stainless steel for metallic piping.
(2) PVC or CPVC to match non-metallic piping.

e. Bolting Materials: Type 316 stainless steel.

f. Diaphragm, O-Rings, and Gasket Materials:

Process Fluid	Diaphragm	O-Ring	Gasket
Sodium Hypochlorite	Teflon	Teflon	Teflon

2. Filling Liquid: In accordance with manufactures recommendations.

3. Working Pressure Rating: Equal to or greater than the attached gage or switch operating pressure specified in Contract Documents.

C. Accessories

1. Provide fill/bleed screw to permit filling of instrument and diaphragm seal.
2. Provide a clean-out ring which holds the diaphragm captive in the upper housing to allow the upper housing assembly to be removed for recalibration or cleaning of the process side housing without the loss of filling liquid or change in calibration.

D. Products and Manufacturers: Provide one of the following:

1. WIKA
2. Or approved equal.

2.03 RESIDUAL (TOTAL AND FREE) CHLORINE & PH ANALYZER

A. General: Unit shall use Amperometric to analyze and indicate total chlorine residual in a sample piped to the unit.

B. Required Features

1. Range: 0 – 10 mg/L

2. Accuracy: ± 6% F.S

3. Sensitivity: 0.001 mg/L or 1% of full scale, whichever is greater.

4. Repeatability: 0.001 mg/L or 1% of full scale range, whichever is greater.

5. Stability: ±1% of full scale for one month.

6. Response Speed: 90% of change within 60 seconds after sample entry.

7. Output Signal: Isolated 4 to 20 mA.

8. Piping Connections: 3/4-inch female NPT sample line, 1 1/4-inch female NPT drain connection.

9. Temperature: 35 to 125 degrees F. Provide automatic compensation for sample temperature.

10. Enclosure: NEMA 4X.

11. Power: 120 VAC ±10%.

12. Display: Four digit LED and a 16 character display.

13. Operator Keypad Menu:

a. mg/L total residual.
b. Cell current in microamps.
c. Sample temperature in degrees F or C.
d. Feed rate in ml/hour.

e. High and low alarm setpoints.
f. Backflush cycles per day.
g. Output signal in mADC.
h. Access code status.

14. Accessories:

a. Include sufficient quantities of reagents and expendables for one year of operation.

C. Products and Manufacturers: Provide one of the following:

1. Depolox 3 Plus as manufactured by Wallace &Tiernan.

2.04 RADAR LEVEL

A. Type: Non-contact system using transducer to convert electrical pulses from the transmitter into sonic pulses directed towards the metered surface and receives the reflected sonic pulses and convert them back into electrical pulses for reception by the transmitter. Transmitter shall generate and time the electrical pulses, and count and convert the pulse travel times into an analog output signal linearly proportional to level/flow.

B. System Performance Requirements

1. Accuracy: Not less than ±1% of full scale range.

2. Linearity and Repeatability: Not less than ±1% of full scale.

3. Minimum Operating Distance from Transducer (Deadband): 18 inches.

4. Beam Pattern: 7 degree conical.

5. Transmitter Outputs: Provide each of the following:

a. 4-20 madc, direct acting and isolated, into 0-1000 ohms.
b. Minimum of four independently adjustable alarm setpoint relays with SPDT contact outputs rated at 5 amps, 120 vd-c resistive.
c. Loss of echo relay which energizes when measured level falls beyond signal range or signal is interrupted for any other reason. Relay output shall be a SPDT contact rated 5 amps 125 vd-c resistive.

6. Power Consumption: 25 watts maximum.

C. Required Features

1. Transducer:

   a. Encapsulated by a corrosion resistant and submergence resistant material: PVC, Kynar or Halan, SUITABLE FOR: Fluoride and Sodium Hypochlorite.
   b. Explosion proof (Class 1, Division 1, Group D).
   c. Designed ANSI 150 pound flanges for flange mounting.
   d. 3/4-inch external NPT conduit connection.

2. Transmitter:

   a. Solid state construction.
   b. Built-in digital filtering for EMI protection and external acoustical noise rejection.
   c. Built-in automatic compensation for variations in temperature, pressure and density of the sonic signal medium.
   d. Range changeable in the field by use of plug-in range modules, eliminating the necessity for rewiring or recalibration.
   e. Potentiometers for zero and span adjustment over 0-100% of the calibrated range.
   f. Distance or Height Mode of operation selectable via internal switch.
   g. Lost Echo and Power On Lights.
   h. Housed in weatherproof, splashproof and corrosion resistant NEMA 4X enclosure heated by electric heating element and suitable wall or pipe stand mounting. Provide with a transparent window to permit viewing indicating meter and lights.
   i. Internally mounted diagnostic LED's to allow isolation of faults in terms of major components.

3. Accessories:

   a. Special PVC jacketed coaxial cable, of the actual length required, for connection between the transducer and transmitter.
   b. Surge protector for 120VAC and DC signal mounted in a NEMA 4X 316 stainless steel box.

D. Product Manufacturer: Provide ultrasonic level transmitters of one of the following:

1. Endress Hauser.
2. Siemens.

2.05 MAGNETIC FLOWTUBE AND TRANSMITTER

A. Functions

1. Flowtube: Produce low level, high impedance pulsed d-c signal proportional to the rate of fluid flow using the principle of electromagnetic induction.
2. Pulsed d-c Magnetic Flow Transmitter: Drive the flowtube coils with pulsed d-c power and convert the flowtube output signal into a d-c current output linear to the flow rate.

B. System (Flowtube and Transmitter) Performance Requirements

1. System Accuracy (with Analog Output): ±0.5% of flow rate or better over range from 1 fps to 31 fps; ±.005 fps or better at flows below 1 fps flow range.

2. System Repeatability: ±0.15% of flow rate or ±.0015 fps, whichever is greater.

3. Drift: Complete zero stability.

4. Minimum Fluid Conductivity Limit: 5 micro-siemens per centimeter or less.

5. Minimum Pre-amp Input Impedance: 10^{12} ohms.

6. Fluid Property Effects: Accuracy unaffected by changes in fluid velocity, density, pressure, temperature or conductivity (above minimum conductivity limits).

7. Transmitter Outputs:

   a. 4-20 madc, direct acting and isolated, into 0-1000 ohms.
   b. High accuracy, field adjustable scaled pulse output (0.1 to 10 Hz or greater) to drive local totalizer.

8. Power Consumption: Not to exceed 50 watts for flowtube and transmitter combined.

9. Operating Temperature: Suitable for operation with process fluid temperature from 0 to 140 F.

10. Pressure Rating: 150 psi.

C. Construction and Required Features

1. Flowtube:

a. Type: Lined metal flowtubes.

b. Interchangeability: Ratio of flow velocity to voltage reference signals generated identical for all meter sizes to permit interchangeability with transmitter without requiring circuit modifications.

c. System accuracy shall be proven by submittal of flow test curves of the actual meters being furnished.

d. Test curves shall show a minimum of ten equally spaced flow points. Tests shall be performed using water and a weight or volume tank. A "Master Meter" used as a reference standard is not acceptable. The test setup shall be submitted and approved prior to testing.

e. Tube Material:

(1) Meter tubes 12-inch and smaller: Type 304 stainless steel.
(2) Metering tubes 14-inch and larger: Type 304 stainless steel, 0.125-inch wall thickness.

f. Electrodes:

(1) Conical or elliptical shaped.
(2) Material: Type 316 stainless steel.

g. Lining: Rubber.

h. Enclosure:

(1) Materials and Rating: Cast low-copper aluminum alloy or fabricated sheet steel, NEMA 6P rated and capable of withstanding accidental submergence in 30 feet of water for 48 hours.
(2) Finish: Finish exterior, except for flange faces, with a high build epoxy paint.

i. End Connections: ANSI Class 150 suitable for mating with pipe specified.

j. Electrical Connections: 3/4-inch NPT tapped holes for power conduit fitting and signal conduit fittings.

2. Pulsed d-c Magnetic Flow Transmitter:

a. Solid state construction.

b. Pulse and analog outputs galvanically isolated from input and earth ground.

c. Automatic zeroing feature making it unnecessary to zero the instrument before or after placing it in operation.

d. Pre-calibrated span adjustment providing continuous span adjustment over entire range.

e. Range adjustment: Direct reading thumbwheel switches or calibrated potentiometer, continuously adjustable for full scale settings from 1 to 31 feet per second.

f. Signal Conditioning: Adjustable damping circuit with response times of 1 to 25 seconds minimum.

g. Low Flow Cutoff: Provide automatic low flow cutoff circuitry to stop pulse output and local totalization when flow drops below 0.5% ±0.2% of the calibrated upper range valve.

h. Enclosure:

(1) Die cast, low-copper aluminum alloy, NEMA 4.
(2) Finish: Epoxy coating.

i. Mounting:

(1) All transmitter and driver electronics shall be remotely mounted from the flow tubes at locations shown.
(2) Provide complete Type 316 stainless steel mounting hardware.
(3) Type of mounting (wall, support frame or pipe stand) as required.

j. Local Indication:

(1) 3-1/2 digit minimum LCD meter with field selectable engineering units or 0 to 100% display; or analog milliammeter with linear 0 to 100% scale for flow rate indication. Provide stainless steel tag indicating 100% value in engineering units as specified in the Instrument List.
(2) 7-digit electromechanical totalizer or 8-digit electronic LCD totalizer with reset and lithium battery backup. Count scaling shall be as specified in the Instrument List. Totalizer shall be integral with transmitter and visible through viewing window, or shall be externally mounted in a separate NEMA 4X enclosure or condulet with viewing window and installed adjacent to the transmitter.

k. Power Requirements: Designed for operation on 120 va-c ±10%, 60 Hz, ±3 Hz power supply.

3. Accessories:

a. Shielded cable assemblies of sufficient length for connection between flowtube and transmitter electronics.
b. 316 stainless steel grounding rings for flowtubes.
c. 316 stainless steel grounding straps.
d. The Contractor shall provide a NEMA 4X rated SPST ON-OFF manual disconnect switch for 120 vac input power to transmitter and driver electronics.
e. Provide spool piece for replacement of each different size flow tube where no bypass piping is provided.
f. Provide one calibrator suitable to calibrate all flow tubes provided.
g. Surge protector for 120VAC and DC signal mounted in a NEMA 4X 316 stainless steel box.

D. Product and Manufacturer

1. Emerson-Rosemount.

2.06 FLOAT SWITCH

A. General: The device shall be capable of detecting fluid level and initiating a signal.

B. Type: Direct acting float.

C. Required Features

1. Sealed SPDT control switch (non-mercury).
2. Actuation by steel ball.
3. High impact, corrosion resistant, PVC float material.
4. Heavy duty neoprene jacketed cable with waterproof connection. Cable length as required.
5. Not sensitive to rotation.
6. Operating temperature: 0 to 140°F.
7. Provide cable weight or mounting bracket to suit installation.

D. Product and Manufacturer: Provide one of the following:

1. Roto-float.

2.07 CONDUCTIVITY

A. System Description

1. Performance Requirements

a. Measurement range:

(1) Conductivity: 0 to 200 micro Siemens/cm, up to 0 to 2,000,000 micro Siemens/cm.
(2) Temperature: -10 to 200 °C (14 to 392 °F).

B. Certifications

1. General Purpose CSA/CSA and FM (UL Pending) when used with an approved controller.
2. Class 1, Division 2, Groups A through D CSA/CSA and FM (UL Pending) when used with an approved controller.

C. Environmental Requirements

1. Operational Criteria:

a. Operating temperature: 14 to 392 °F, limited only by sensor body material and mounting hardware.

b. Pressure and temperature limits, depending on materials:

(1) Polypropylene: 100 psi at 212 °F (6.9 bar at 100 °C).
(2) PVDF: 100 psi at 248 °F (6.9 bar at 120 °C).
(3) PEEK: 200 psi at 392 °F (13.8 bar at 200 °C).
(4) PFA Teflon: 200 psi at 392° F (13.8 bar at 200 °C).

c. Flow rate: 10 ft./s (3 m/s), maximum.

D. Manufactured Unit

1. The Hach 3700-SC Electrodeless Conductivity System consists of:

a. Union mount probe.
b. Integral cable.
c. Digital gateway device.

E. Equipment

1. The 3700-SC system shall include Hach models sc100.
2. The probe has a built in Pt 1000 RTD temperature compensator.
3. The wetted material shall be suitable for raw sewage.

F. Mounting Type

1. Sanitary style for inline flow, 2-inch sanitary mount flange to mount into a standard 2-inch sanitary tee.

G. Accessories

1. Mounting hardware.
2. Surge protector EDCO SLAC.

2.08 ION CONCENTRATION

A. The pH Analyzer Element and Transmitter shall be a microprocessorbased process control instrument with measurement ranges of 0 to 14 pH units, and 0 to ± 2000 mV. The controller shall provide automatic temperature compensation and measurements from 0-60 degree C. The pH controller shall be housed in a NEMA 4X, ABS plastic case. The power requirement shall be 120/240 ±10% VAC, 50/60 Hz, 2.5 W. A 3-VDC lithium cell shall be used for backup during power failure. Accuracy shall be ± 0.05 pH units, ±10 mV and ±1 degree C. Repeatability and resolution shall be ±0.1 pH unit, ±3 mV and ±1 degree C. Operator selectable functions for pH, mV, temperature and alarm set-point selection shall be provided by front panel mounted, touch-sensitive switches. Results of measurements shall be displayed on a liquid crystal display (LCD).

B. Two independent SPDT n.o./n.c. relays with dry contacts shall be provided for high and low alarm outputs. Alarm points shall be fully adjustable over the entire measurement range of the instrument for pH and mV functions. An isolated 4-20 mA recorder output also shall be provided.

C. The controller shall be capable of operation in either of two recorder output modes. Mode 1 shall provide a 4-20 mA current output proportional to 0-14 pH units and a 15-112 pulses-per-minute programmable frequency output for proportional control of other process equipment. Mode 2 shall provide a 4-20 mA programmable current output over any pre-selected pH range of 0.5 units or greater and a 15-112 pulses per minute frequency output proportional to the full range of 0-14 pH units.

D. A sensor for in-line installation shall be provided. The sensor shall incorporate a replaceable, non-clogging, flat bulb glass combination Ag/AgCI pH electrode housed in a CPVC enclosure containing 316 stainless steel guards with solution ground and Viton 0-ring seals. The sensor shall have a measurement range of 0-14 pH units and operate at a line pressure of 150 psig at 25 degree C.

E. The pH analyzer element and transmitter shall be Hach SC200 with pH sensor.

2.09 PRESSURE SWITCH

A. Type

1. Bourdon tube pressure actuated.
2. One or two SPDT switches as required.

B. Operation

1. Purpose: To provide a contact output at a predetermined pressure value.
2. Operating Principle: Bourdon tube pressure element coupled to a magnetic mercury switch.

C. Functional

1. Contact Rating: 10 amp to 120 volts ac.
2. Adjustable Differential automatic reset.
3. Range: As required.
4. Differential: 1.5 psi.

D. Physical

1. Case Size: Approximately 6-inch.
2. Case Material: Stainless Steel.
3. Process Connection: 1/4-inch NPT.
4. Double setpoint external to switch cover.

E. Manufacturer

1. Mercoid DAW series.

2.10 DISSOLVED OXYGEN

A. General: Multi-Parameter Analyzer Transmitter for monitoring process variables with remote sensors and air cleaning systems.

B. Multi-Parameter Analyzer Transmitter

1. Endress+Hauser Liquiline CM44x/CM44xR digital transmitter.

2. Ethernet/IP Communications.

3. 32 to 140F, non-condensing.

4. Shall be a multi-parameter controller with up to eight measuring channels based on digital Memosens technology.

5. Programmed computations and features resident in nonvolatile memory.

6. Transmitter firmware shall be upgradable in the field by the user or a factory technician, without removing the transmitter from service.

7. Transmitter shall be available in a NEMA 4X field housing with integral display or a DIN rail-mount version for cabinet mounting with remote display.

8. Digital communications provides for plug and play for all sensor configurations.

9. Shall be capable of modification for new or extended functions by use of modular components that are easily retrofitted in the field without the aid of tools, and without the need to power down the transmitter or re-boot the system.

10. Simple wiring for all types of digital Memosens sensors plus an option for a M12 sensor connector.

11. Digital communications protocols available shall include the following without using an external converter. Digital communication shall be available as a native output from the sampler. Use of an external third-party signal converter is not acceptable.

    a. 4-20mA, HART.
    b. Profibus RS485 with webserver.
    c. Modbus RS485 with webserver.
    d. Modbus TCP with webserver.
    e. EtherNet/IP with webserver.

12. EtherNet/IP communication shall be supported with the Electronic Data Sheet (EDS) file available for download directly from the sampler. The Add-On Profile (AOP) for integration shall be a Level 3 profile to simplify control system integration.

13. The EtherNet/IP communications shall also be supported with Add-on Instructions (AOI) files and pre-configured faceplates for ease of control system integration.

14. Transmitter shall have an option for relay outputs, analog inputs, and discrete input/outputs.

15. Project Protocol: Ethernet/IP:

    a. ODVA certification.

    b. Device profile: Generic device (product type: 0x2B).

c. Manufacturer ID: 0x049Eh.

d. Device type ID: 0x109Ch.

e. Polarity: Auto-MIDI-X.

f. Connections (max.) CIP: 12.

g. Minimum RPI: 100 ms (default).

h. Maximum RPI: 10,000 ms.

i. System integration: EtherNet/IP.

j. Rockwell: Add-on Profile Level 3, Faceplate for FactoryTalk SE.

k. IO data: Input.

l. Measured values:

(1) 16 AI (analog input) + Status + Unit.
(2) 8 DI (discrete input) + Status.
(3) 4 A0 (analog output) + Status + Unit.
(4) 8 DO (discrete output) + Status.

16. Storage of all measured values, incl. values of external sources, in the non-volatile memory.

17. Data called up on site via user-defined measuring menu and load curve display of the data logbook.

18. Data export to csv file (for Microsoft Excel).

19. Integral web-server for remote operation, diagnostics, and configuration.

20. The transmitter/controller allows sensors to be “hot swapped” and recognized without the need to reset or power down the system. (Only ultrasonic interface sensor inputs must be predefined with all other sensor inputs automatically recognized upon connection, following initial configuration.)

21. The transmitter/controller provides connections for up to 27 different Endress+Hauser digital Memosens® protocol-based sensors in addition to Memosens sensors from other manufacturers.

22. The transmitter/controller has the following power requirements:

    a. Standard: Universal AC powered: 100 to 230 VAC ±15%, 50/60 Hz:

23. The transmitter/controller uses a menu-driven operating system with context sensitive “soft” keys.

24. The transmitter/controller uses a back-lit, transflective graphic display with red display background to indicate critical alarms.

25. The transmitter/controller includes a real-time clock that is backed up by a user replaceable, commercially available watch-style battery.

26. The transmitter/controller has user security features.

27. The transmitter/controller has internal memory for up to 150,000 data points per data log and allows up to eight data logs to be configured by the user for any available parameters with data scan rate definable from 1 second up to 1 hour per data point. Data logs shall be downloaded to customer provided SD card in CSV or FDM file formats. Data logs shall also be displayed in list and graphic formats on the transmitter/controller display.

28. The transmitter/controller includes a built-in industrial SD flash drive card reader to facilitate sensor and transmitter/controller firmware updates/upgrades, downloading data, event, configuration and calibration logs, backing up complete configurations, and copying configurations to multiple devices via industrial SD card with up to 2 GB capacity.

29. One user-definable, fully programmable SPDT alarm relay is provided and rated at 0.5 amp for a minimum of 450,000 cycles with switching voltage of 230 VAC; 650,000 cycles with switching voltage of 115 VAC; and 350,000 with switching voltage of 24 VDC.

30. Up to four fully user-definable, fully programmable SPDT relay outputs are available with rating up to 2 amps for a minimum of 120,000 cycles with switching voltage of 230 VAC; 170,000 cycles with switching voltage of 115 VAC; and 150,000 with switching voltage of 24 VDC.

31. The transmitter/controller shall be equipped or upgraded to a maximum total of eight 4-20 mA outputs with a maximum load of 500 ohms per output, depending on the module configuration.

C. Accessories

1. The transmitter shall be mounted in a NEMA 4X, all 316 stainless steel wall mounted enclosure, painted white, with legs. Enclosure shall include aluminum back plate, ground lug, 3-point latch and sunshield for top, and sides, 120VAC circuit breaker, 120VAC and DC by EDCO or Citel surge protection. Enclosure shall be manufactured by Hoffman or Saginaw.

2. Programmable compressed air clean system for each probe as manufactured by Endress+Hauser BA:

    a. Max. 3 minutes cleaning, break of at least six times the cleaning time.
    b. 120VAC, 325 watt compressor, 250 watt heater.
    c. -10 to +55 °C (+14 to +131 °F).
    d. Automatic switch-off at T > 130 °C (266 °F) in the motor (winding sensor).
    e. Max. continuous pressure 100 PSI.

3. Mounting system shall be a 316 stainless steel holder designed for floor or wall mounting on basin or channel as manufactured by Endress+Hauser CYH112. Handrail mounting not allowed.

4. PC software for central data management.

5. External Graphic Display for panel mounting on front door.

6. Fluorescence Dissolved Oxygen Sensor:

    a. Endress+Hauser Oxymax COS61D digital oxygen sensor with Liquiline CM44 transmitter.
    b. 316 stainless steel upright post and fixed immersion assembly.
    c. Measurement Range: 0-20 mg/l, 0-200 %SAT, 0-400 hPa.
    d. Repeatability: ±0.5% of measuring range end.
    e. Max Measured Error: 0.01 mg/l or ±1 % of measured value (< 12 mg/l) ±2 % of measured value (from 12 to 20 mg/l).
    f. Response time (t90): 60 sec.
    g. Sensor cap lifetime: >2 years (under reference operating conditions, protected against direct sunlight).

h. Temperature Sensor: NTC temperature sensor, 0-50C (32-122F).
i. Calibration kit.

7. pH/ORP Sensor:

a. Requirements for a pH/ORP sensor for in-process measurement. The sensor will incorporate Memosens® digital technology for maximum process and data integrity with simple operation. The sensor-to-cable connection will use a moisture-resistant inductive connection that resists corrosion, enabling lab calibration while facilitating predictive maintenance. The sensor must have galvanic isolation from the transmitter and cable. The sensor shall be calibrated prior to leaving the producing factory with calibration data including the date and time of the calibration stored within the sensor, for immediate installation without the need for post-installation field calibration.

b. Measurement Range:

(1) pH: 0-14 pH.
(2) ORP -1500 mV to 1500 mV.

c. Temperature range: Sensor dependent; 5 to 275 °F.

d. Lengths: Available in 120, 225, 360 or 425 mm lengths (sensor dependent).

e. Acceptable sensor temperature range options:

(1) 5 to 176 °F (-15 to 80 °C).
(2) 32 to 176 °F (0 to 80 °C).
(3) 32 to 275 °F (0 to 135 °C).

f. Pressure: Sensor dependent; up to 232 psi maximum.

g. Cable length (between sensor and transmitter): 330 feet (100 m) maximum.

h. The Endress+Hauser Memosens® pH or ORP Sensor system consists of the following sensors and a Liquiline CM 44x or CM44xR transmitter.

i. pH sensors: Orbisint CPS11D, Ceragel CPS71D, Orbipore CPS91D, Ceraliquid CPS41D, Tophit CPS441D, Tophit

CPS471D, Tophit CPS491D, Orbipac CPF81D or Ceramax CPS341D.

j. ORP sensors: Orbisint CPS12D ORP, Ceragel CPS72D ORP, or Ceraliquid CPS42D.

k. Combination pH/ORP sensors: CPS16D, CPS76D, or CPS96D.

l. Completely encapsulated sensor having no fixed cable and no metallic contacts. Sensor must be galvanically isolated from the transmitter and cable, use a non-proprietary inductive coupling system, pH glass or ORP noble metal measurement electrode and reference system with fouling resistant diaphragm.

m. Sensor does not require replacement parts or electrolyte solutions.

n. Standard cables are available for connection of the sensor to a suitable transmitter in lengths of 3, 5, 10, 15, and 25 meters with special lengths and extensions available up to 100 meters.

o. Wetted materials:

(1) Glass sensor with PTFE, ceramic or open junction.
(2) PEEK sensor with EPDM and ceramic or open junction.

p. Standard available holder materials for industry-standard 120 mm x 12 mm sensors with PG13.5 connection to holder:

(1) PVDF (Kynar® or equivalent).
(2) Stainless steel (316L).
(3) Polyoxymethylene (POM).
(4) Polypropylene (PP).
(5) PVC.

q. Sensors shall work with digital transmitter designed to operate with Memosens® pH or ORP sensors.

r. pH and ORP sensors shall have a built in temperature compensator.

s. Various mounting configurations shall be possible using a range of holders, including:

(1) Pipe nipple for mounting in a pipe or tank.
(2) Immersion holders for installation in open channels, basins or tanks.
(3) Endress+Hauser CYA112/CYH112 submersion mounting and suspension system (all versions). (Additional information needed for configuration of CYA112/CYH112 hardware.)
(4) Immersion assemblies for installation in tanks or pipes with the requirement for manual or automated retraction of the sensor from the process without disrupting the process.

t. Calibration solutions shall be available for both pH sensors (buffer solutions, pH 4 and pH 7 recommended) and ORP sensors.

u. Cleaning assemblies shall be provided for in-process sensor cleaning using air.

2.11 PRESSURE TRANSMITTER

A. Type

1. Capacitance Cell.
2. Electronic Output.
3. NEMA 4X enclosure.

B. Operation

1. Purpose: To sense variations in pressure and produce a standard current output signal linear with the pressure.
2. Sensing Element: Differential-capacitance cell
3. Indicator: Integrally mounted.

C. Functional

1. Over Pressure Limits: 3,600 psig (min) unless otherwise required.
2. Power Supply: 10-55Vdc.
3. Output: 4-20 mA dc.
4. Process Connections: 1/2-inch NPT.

D. Physical

1. Body Material: Low copper aluminum.
2. Wetted Parts: 316 SST.
3. Electronics Housing: NEMA 4X.
4. Teflon 0-rings.
5. Coplanar Flange.
6. Wall Mounting Bracket.

E. Performance

1. Accuracy: Plus or minus 0.1% of span.
2. Indicator Accuracy: Plus or minus 2.0% of span.

F. Diaphragm Seal

1. Thread attached.
2. Welded metal diaphragm above 15 psi.
3. Clamped Viton for below 15 psi and vacuum.
4. Exposed Surfaces - 316 stainless steel.
5. Continuous duty.

G. Provide transient surge protection as manufactured by EDCO PC642 in NEMA 4X, 316 stainless steel box.

H. Manufacturer

1. Rosemount Smart.
2. Endress-Hauser Smart.

PART 3 EXECUTION

3.01 INSTRUMENTATION INSTALLATION REQUIREMENTS

A. Instruments shall be installed and calibrated in accordance with the following requirements.

B. Field Calibration: After each instrument has been installed, a technical representative of the Contractor shall calibrate each instrument and shall provide a written calibration report for each instrument, indicating the results and final settings. The adjustments of calibrated instruments shall be sealed or marked, insofar as possible, to discourage tampering. Instrument calibration shall be done before checkout of the system operation. A typical instrument calibration report is attached to the end of this Section. Calibration Data Sheets shall be submitted in a

single 3-ring binder when calibration of all instruments has been completed. Instruments shall be calibrated at 0, 25, 50, 75, and 100% of its calibrated range.

C. Systems Check: A technical representative of the Contractor shall participate in the checkout of instrumentation systems. Systems check requirements shall be as specified in Section 13400, Process Control System Start-Up and Field Testing.

D. Installation Test Equipment: Unless specified otherwise, all test equipment for the calibration and checking of system components shall be provided by the Contractor for the duration of the testing work and this test equipment will remain the property of the Contractor.

E. Mounting of Field Instruments: Instruments shall be mounted so that they can be easily read and serviced, and so that all appurtenant devices can be easily operated. Typical installation details for some instruments are indicated on the Drawings.

1. Instruments shall be mounted such that all readouts upright and are easily readable from directly in front of the instrument.
2. Instruments and process or electrical connections shall be made in a neat and professional manner such that they are not a trip hazard or interfere with routine maintenance.
3. Instruments which require bleeding of process lines for calibration shall be located such that liquid is not spilled on other equipment or in areas where it could be considered a hazard or nuisance. If this is not possible, provide a means to drain or convey the liquid to a suitable location. The Engineer and Owner shall make the final to determination if an installation is acceptable. Installations deemed not acceptable shall be modified by the Contractor at no additional cost to the Owner.

3.02 CUSTOMER TRAINING

A. Instrumentation training requirements are outlined in Section 13300, Plant Monitoring and Control System Training.

INSTRUMENT NAME & SERVICE:		
MANUFACTURER, MODEL NO., SERIAL NO.:		
TAG OR LOOP NO.:		
INPUT/OUTPUT RANGE:		
INPUT	ACTUAL OUTPUT	DESIRED OUTPUT
PROPORTIONAL BAND:		
RESET:		
POSITION OF SWITCHES, JUMPERS, ETC.		
COMMENTS:		
DATE OF CALIBRATION: CALIBRATED BY:		
	INSTRUMENT CALIBRATION REPORT	Figure 1

END OF SECTION

SECTION 13090
PROCESS CONTROL PANELS AND HARDWARE

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. The Contractor and the PICS Supplier shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place into satisfactory operation all process control panels and enclosures for their respective equipment.

Designation	NAMA Rating	Enclosure Material	Mounting
PLC-A	12	Painted Steel	Free Standing
PLC-B	12	Painted Steel	Free Standing

1.02 QUALITY ASSURANCE

A. Standards, Codes and Regulations

1. Construction of panels and the installation and interconnection of all equipment and devices mounted within shall comply with applicable provisions of the following standards, codes and regulations:

    a. National Fire Protection Association 79, Annex “D” Standards, (NFPA).
    b. National Electrical Code, (NEC).
    c. National Electrical Manufacturer's Association Standards, (NEMA).
    d. American Society for Testing and Materials, (ASTM).
    e. Operational Safety and Health Administration Regulations, (OSHA).
    f. Underwriters’ Laboratory, Inc., (UL).
    g. State and Local code requirements.
    h. Where any conflict arises between codes or standards, the more stringent requirement shall apply.

2. All materials and equipment shall be new and all panels shall be built in an Underwriters’ Laboratory, Inc. (UL) approved panel shop and bear the UL label.

B. General Design Requirements

1. Comply with the requirements of Section 13600, Process Control System General Provisions.
2. Comply with the control descriptions of Section 13030, Software Control Block Descriptions.

C. Factory Assembly and Testing

1. Comply with the requirements of Section 13500, Process Control System Factory Testing.

1.03 SUBMITTALS

A. Comply with the requirements of Section 13600, Process Control System General Provisions.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Comply with the requirements of Section 13600, Process Control System General Provisions.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Provide all electrical and/or pneumatic components and devices, support hardware, fasteners, interconnecting wiring and/or piping required to make the control panels and/or enclosures complete and operational.

B. Panels and Enclosures shall be UL 508A and devices therein shall be UL508 listed.

C. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

D. Components for installation on panel exterior shall be located generally as shown. Layouts shall be submitted for review in accordance with Section 13600, Process Control System General Provisions.

E. Where permitted by location and layout as shown, panels and enclosures shall have full height rear access doors. Where rear doors are not possible, panels shall have full or half height front access doors.

F. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

G. Provide sub-panels for installation of all relays and other internally mounted components.

H. All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.

I. Provide copper grounding studs for all panel equipment.

J. Provide the following convenience accessories inside of each control panel:

1. One 120 VAC, 20A duplex, grounding type receptacle.
2. One or more 120 VAC fluorescent light fixtures with 40 watt lamp and protective plastic shield to span across the width of the panel but not less than two-thirds the width of the panel, as a minimum.
3. One 120 VAC, 20A, snap switch, to turn on the light, mounted in an outlet box with a cover and located so that it is easily accessible from access door.
4. Service light with switch and duplex receptacle shall have its own circuit breaker and separate power feed.

K. The bottom 12 inches of free standing panels shall be free of all devices, including terminal strips, to provide ease of installation and testing.

L. No device shall be mounted less than 36 inches above the operating floor level, unless otherwise specified.

2.02 IDENTIFICATION

A. Provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:

1. Nameplates shall be of 3/32-inch-thick laminated phenolic type with white matte finish surface and black letter engraving.
2. Panel identification nameplates to have 1/2-inch-high letter engravings.
3. Panel mounted component (e.g., control devices, indicating lights, selector switches, etc.) identification nameplates to have 1/4-inch-high letter engravings.
4. Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.
5. Nameplate engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.

B. Tag all internally mounted instruments in accordance with the following requirements:

1. Tag numbers shall be as listed in the Instrument Index.
2. The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self-tapping screws of appropriate size.
3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch-diameter stainless steel wire rope.
4. Identification tag shall be installed so that the numbers are easily visible to service personnel.
5. Front of panel mounted instruments shall have the tag attached to rear of device.

C. Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.

1. Tag all electrical devices (e.g., relays, timers, power supplies) mounted within control panels and enclosures.
2. Tag all pneumatic lines.
3. Numerically tag all terminal blocks.
4. Color code and numerically tag wiring at each end.

2.03 PANELS AND ENCLOSURES

A. General

1. Panels and enclosures shall meet the NEMA requirements for the type specified.
2. Sizes shown are estimates. The Contractor shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, tubing and other components installed within, as required.

B. Construction Features

1. Control panels located inside environmentally controlled (conditioned spaces) room areas shall be NEMA 12 rated.

    a. Fabricate enclosures using minimum 14-gage steel for wall or frame mounted enclosures and minimum 12-gage for free standing enclosures. Steel shall be free of pitting and surface blemishes.

b. Continuously weld all exterior seams and grind smooth. Also, surface grind complete removal of corrosion, burrs, sharp edges and mill scale.

c. Reinforce sheet steel with steel angles where necessary to adequately support equipment and ensure rigidity and to preclude resonant vibrations.

d. Panel shall be flat within 1/16 inch over a 24-inch by 24-inch area, or flat within 1/8 inch for a larger surface. Flatness shall be checked by using a 72-inch-long straight edge. Out-of-flatness shall be gradual, in one direction only, and shall not consist of obvious depressions or a series of wavy sections.

e. Use pan type construction for doors. Door widths shall not exceed 36 inches.

f. Mount doors with full-length heavy-duty piano hinge with stainless steel hinge pins.

g. Provide oil resistant gasket completely around each door or opening.

h. Provide handle-operated, oil-tight, key-lockable three-point stainless steel latching system with rollers on latch-rods for easy door closing.

i. Use stainless steel fasteners throughout.

j. Provide interior mounting panels and shelves constructed of minimum 12-gage steel with a white enamel finish.

k. Provide steel print pocket with white enamel finish.

l. Provide enclosure mounting supports as required for floor, frame, or wall mounting.

m. Provide all holes and cutouts for installation of conduit and equipment. Cable and piping to enter the enclosure through the bottom, unless otherwise noted. All conduit and piping openings and all conduits entering cabinet shall be sealed watertight.

n. Completely clean all interior and exterior surfaces so they are free of corrosive residue, oil, grease and dirt. Zinc phosphatize for corrosion protection.

o. One coat of primer shall be applied to all interior and exterior surfaces immediately after corrosion protection has been applied. Exterior surfaces shall then be given sufficient coats of primer surfacer, applied with sanding and cleaning between coats, until a Grade 1 finish can be produced on the finish coat.

p. All interior surfaces shall be painted with two coats of semi-gloss white polyurethane enamel.

q. Provide interior back panel for mounting of panel components and for easy removal of component system. Panel to be steel, powder coated black.

r. All exterior surfaces shall be painted with a minimum of three finish coats of polyurethane enamel to ultimately produce a Grade 1 finish (super smooth; completely free of imperfections). Color to be selected by the Engineer from complete selection of standard and custom color charts furnished by the manufacturer. Provide one extra quart of touch-up paint for each exterior finish color.

s. Primer and finish paint shall be compatible and shall be a low VOC, high solids polyurethane enamel, Hi-Solids Polyurethane B65 W300 Series as manufactured by Sherwin-Williams, Inc. or equal. Provide one extra quart of Primer and finish paint.

2. Control panels located in field (outdoor and/or in non-conditioned spaces) shall be NEMA 4X rated.

a. Panels shall be Type 316L stainless steel construction with a minimum thickness of 12-gage for all surfaces (except those areas requiring reinforcement) having a smooth brushed finish.

b. Provide handle-operated, oil-tight, key-lockable three-point stainless steel latching system with rollers on latch-rods for easy door closing.

c. Rolled lip around three sides of door and along top of enclosure opening.

d. Hasp and staple for padlocking.

e. Provide a, gasketed lockable hinged door to encompass all non-NEMA 4 front of panel instruments.

f. Provide 3-inch-high channel base assembly, with solid bottom, drilled to mate the panel to its floor pad.

g. Floor Pad: Refer to Part 3 of this Section.

h. Provide interior back panel for mounting of panel components and for easy removal of component system. Panel to be steel, powder coated black.

3. Where the application applies and with the approval of the Engineer, wall mounted enclosures may be provided. The enclosure shall comply with Paragraph B.1., B.2. or B.3., except for the following:

a. Locations shall be as shown on or as specified under other sections.

b. Doors shall be full height.

c. Corrosion resistant polyester quick release latches shall be provided.

d. No extra holes or knockouts shall be provided. No light or convenience outlet need be provided.

4. For panels located outdoors, provide sunshields and white epoxy coating on panel exterior, this includes stainless steel. Coordinate proper etching primer for epoxy adhesion. Refer to Instrumentation details shown on the drawings for additional requirements.

C. Electrical Systems

1. Control of Environment:

a. Outdoor Panels (or Panels located in non-conditioned spaces):

(1) Provide adequately sized automatically controlled 120 VAC strip heaters to maintain temperature inside each enclosure above 40ºF to maximum of 95ºF when the outside temperature is -20ºF through 40º F.
(2) Provide automatically controlled ventilation fans to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the enclosure. Housing shall be constructed of 316 SS materials.
(3) Provide thermostats to automatically control heating and cooling requirements without need of manual operation of a heating/cooling transfer switch.
(4) Provide documentation if any of the above is deemed unnecessary.

b. Indoor Panels (or Panels located in Conditioned spaces):

(1) Provide adequately sized, automatically controlled 120 VAC strip heaters to maintain temperature 10ºF above ambient for condensation prevention inside panels.
(2) Provide documentation if any of the above is deemed unnecessary.

2. Power Source and Internal Power Distribution:

a. General: Control panel power supply source, type, voltage, number of circuits and circuit ratings shall be as shown.
b. Panels shall be provided with an internal 120 VAC power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components. Distribution panel shall contain two spare breakers, minimum.

3. Wiring:

a. Internal wiring shall be Type MTW and THW, Tinned stranded copper wire with thermoplastic insulation rated for 600 V at 90ºC for single conductors, color coded and labeled with wire identification.
b. For DC panel signal wiring - copper, use No. 16 minimum AWG shielded.
c. For DC power wiring, use No. 16 minimum AWG. For AC signal and control wiring, use No. 16 minimum AWG. For wiring carrying more than 15 A, use sizes required by NEC standards.
d. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6 inches.
e. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1 inch. Troughs shall have 40% spare capacity.
f. Install wire troughs along horizontal or vertical routes to present a neat appearance. Angled runs are not acceptable.
g. Adequately support and restrain all wiring runs to prevent sagging or other movement.
h. Terminate all field wiring (no more than one wire per termination) using screw/clamp type terminals, insulated, crimp-on connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips and permanently affixed numeric identifiers beside each connection. Identifiers to be self-stick plastic tape strips with permanent type, machine printed numbers. For DC field signal wiring, terminal strips shall be capable of handling No. 12 wiring (minimum). Provide Phoenix Contact, Entrelec or Allen Bradley.
i. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.
j. All alarms generated external to the panel, spare alarm, and repeat contacts shall be wired out to terminal blocks.
k. For internal component-to-component wiring only, compression type terminal blocks are acceptable.
l. Provide spare terminals equal in number to 20% of the terminals used for each type of wiring (e.g., DC signal and AC power).
m. Provide a separate terminal for grounding each shielded cable.
n. Use separate 5/16-inch-diameter copper grounding studs for instrument signal cable shields and AC power.
o. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.

p. When DC power and/or low voltage AC power is required, provide and install the necessary power supplies and transformers in the panel.
q. Provide circuit breakers to protect each circuit, with no more than one instruments on a single circuit.
r. Provide complete wiring diagram showing "as-built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

4. Surge Protection:

a. General: Surge protection shall be provided to protect the electronic instrumentation system from surges propagating along the signal and power supply lines.

b. Products and Manufacturers: Provide one of the following:

(1) Phoenix Contact.
(2) Dehl.
(3) Edco.
(4) No approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in conformance with NEC.

B. Unless otherwise noted, install indoor NEMA 12 panels on a 4-inch concrete pad. Extend pad 4 inches beyond outside dimensions of base, all sides. Lay grout after panel sills have been securely fastened down.

C. Unless otherwise noted, install outdoor NEMA 4X panels on a reinforced concrete pedestal:

1. Minimum Thickness: 8 inches with No. 4 steel reinforcing bars at 12 inches on centers, each way.
2. Minimum Size: 12 inches larger than outer dimensions of base, all sides.
3. Provide excavation and backfill work in conformance with Section 02300, Earthwork for Structures.
4. Provide concrete work in conformance with Section 03300, Cast-In-Place Concrete.

D. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into and out of and among the enclosures as indicated on the Drawings.

3.02 TESTING AND ADJUSTMENTS

A. Perform system testing and make any adjustments necessary in accordance with this Section, Section 13600, Process Control System General Provisions, Section 13500, Process Control System Factory Testing, and Section 13400, Process Control System Start-up and Field Testing.

B. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

3.03 SPARE PARTS AND TEST EQUIPMENT

A. The Contractor shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Section.

B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. The following shall constitute the minimum spare parts:

1. Five of each type of input-output relay for each 40 or less furnished for this Contract.
2. One replacement power supply for each type and size furnished for this Contract.
3. A one-year supply of all expendable materials.
4. One per 10 (two, if fewer than 20) of each type of panel mounted instrument including lights, pushbuttons.
5. One dozen of each type and size of fuse used in panels and instruments.

END OF SECTION

SECTION 13100
LARGE MODULAR PRECAST CONCRETE BUILDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The work under this Section includes furnishing all materials, equipment, labor, and incidentals necessary to install two prefabricated, modular, precast, concrete structures as shown on the Drawings and specified herein. The two buildings shall be named *Electrical Building 1* and *Electrical Building 2*.

B. Work for this Section includes coordination with Division 16, Electrical, and the Drawings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit shop drawings signed and sealed by a licensed Florida Professional Engineer for the design, fabrication, and assembly of the modular precast buildings. Indicate on the shop drawings the lifting eye locations and method of lifting the precast sections. Indicate the required connection detail(s) along the perimeter walls.

B. Submit product information for all components used in the manufacture of the building (e.g., reinforcing steel, concrete mix).

C. Submit catalog cut sheets for all architectural (e.g., doors, windows, door hardware), mechanical, electrical equipment, and appurtenances.

D. Provide the locations and details of wall and floor block-out openings for pipes, conduits, equipment, and other utility services entering and exiting through the building side walls and floor.

E. Submit a detailed floor plan and interior elevations showing the dimensioning and locations of all power, signal and control conduits, piping, and other utilities.

F. Submit catalog cut sheets for all architectural (e.g., doors, windows, door hardware), mechanical, electrical equipment, and appurtenances.

G. Submit, for approval, copies of a list of paint materials to be used on the project for both shop and field application. Attach to the list label analysis of the products and manufacturer's recommended application procedures.

H. Submit manufacturer's color chips for the Owner's selection of building colors.

I. Submit for approval details of paint materials used for both shop and field application. Provide the manufacturer's written application procedures.

J. Quality Control

1. Experience records of manufacturer and installer.
2. Approval of installer by manufacturer of structure components.
3. Certification that codes and referenced standards have been met.
4. Description of electrical continuity and grounding methods.
5. Test reports.
6. Certificates of warranty.

1.03 REFERENCED STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document. Standards referenced herein are listed below:

A. American Concrete Institute (ACI)

1. ACI 318—Building Code Requirements for Reinforced Concrete.

B. American Society for Testing and Materials (ASTM)

1. ASTM A615/A615M—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM A1064/A1064M—Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
3. ASTM C260/C260M—Standard Specification for Air-Entraining Admixtures for Concrete.
4. ASTM D3276—Standard Guide for Painting Inspectors (Metal Substrates).

C. Florida Building Code (FBC)

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

B. Manuals shall include:

1. Name, address, and telephone number of the building supplier.
2. Descriptive literature, including illustrations, covering the operational features of the equipment, specific for the particular installation, with all inapplicable information omitted or marked out.
3. Operating, maintenance, and troubleshooting information.
4. Complete connection, interconnecting, and assembly diagrams.
5. Approved shop drawings.

1.06 SYSTEM DESCRIPTION

A. Exterior Dimensions:

1. Electrical Building 1: 20 feet-0 inch x 30 feet-0 inch.
2. Electrical Building 2: 12 feet-0 inch x 28 feet-0 inch.

B. Clear Ceiling Height: 12 feet-0 inch.

C. Roof Slope: Manufacturer’s standard, provided it is at least 1:12.

D. Include doors, and other equipment as described herein and as shown on the Drawings.

E. System: Design, furnish, and install complete building package using manufacturer’s standard components or components as specified herein.

F. Structure: Pre-engineered, single-story, simple single-span, precast concrete.

G. Design: Coordinate building design with electrical equipment specified in Division 16, Electrical, and shown in the Drawings. Coordinate the building design and connection details with the foundation pad shown on the Drawings. All coordination shall be performed with the Contractor before construction.

1.07 QUALITY ASSURANCE

A. Qualifications

1. Designers: Engineers registered in the State of Florida.

2. Manufacturer:

a. At least 5 years' experience in work of the type required in this Section.
b. Production capacity to provide work required for this project without delay.

B. Regulatory Requirements: Design building system to meet requirements of the following:

1. Florida Building Code.
2. ASHRAE 90A-80, Energy Conservation in New Building Design.
3. NFPA 70-2005, National Electrical Code.

1.08 SOURCE QUALITY CONTROL

A. Inspections: Before shipment, inspect for complete, functional assembly.

B. Tests: Perform manufacturer's standard tests and adjustments on mechanical and electrical equipment and other moving and operating components.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide a complete modular precast reinforced concrete building with walls, and roof each of monolithic manufacture, and with the equipment and furnishings as specified and as shown on the Drawings. Building shall be installed on cast-in-place floor slab/foundation constructed by the Contractor. Coordinate the required pad size with the Contractor before construction.

B. The building shall be designed to meet the loading requirements of the Florida Building Code and ACI 318. The minimum design loads shall be:

1. Roof Live Load: 60 psf.
2. Floor Live Load: 100 psf.
3. Floor Dead Load: 75 psf.
4. Windload: 120 mph.

C. The building shall be designed for the following outside temperature conditions: Winter DB, 31°F; Summer DB 93°F; WB 77°F.

2.02 COMPONENTS

A. The building shall be a weathertight structure that has straight, plumb walls with square corners. The building shall be entirely assembled at the plant, sealed waterproof, and tested for water tightness. Buildings too large to be shipped by truck may be assembled on site using pre-cast modular panels, and sealed and tested on site.

B. The building roof shall be designed for a clear span without the use of interior support of any type. Floor, interior walls, exterior walls, and roof surfaces shall be factory finished smooth and be free from pockets, crevices, and surface voids. The building's interior floor plan dimensions and interior finished height shall be as indicated on the drawings or specified herein. Provide integral drip guards above door openings.

C. The exterior walls of precast concrete modules shall be cast with a form mat, 1/2-inch fluted fin architectural design configuration, with cant strip-type extension at base and roof line.

D. The building shall be as manufactured by one of the following:

1. Leesburg Concrete Company, Inc., Leesburg, Florida.
2. Concrete Modular Systems, Inc., St. Petersburg, Florida.
3. Old Castle Precast, Inc., Spring Hill, Florida.
4. A to Z Precast Concrete Products, St. Petersburg, Florida.
5. Or Engineer-Approved Equal.

2.03 CONCRETE

A. Concrete shall be steel-reinforced (ASTM A615/A615M Grade 60 and ASTM A1064/A1064M Welded Wire Fabric), 5,000 psi minimum, 28-Day Compressive Strength, Air-Entrained (ASTM C260/C260M).

2.04 INSULATED BUILDING

A. Exterior walls shall be insulated with a minimum of R13 surfaced with smooth finished interlocking fiberglass panel boards.

B. Roof shall be insulated with a minimum of R20 and surfaced with smooth-finished interlocking fiberglass panel boards.

C. Foam insulation shall comply with Section 2603, FBC.

2.05 DOORS

A. Provide 3-foot-0-inch-wide by 7-foot-0-inch-high double and single doors manufactured from 6063-T5 aluminum alloy extruded tube measuring 1-3/4 inches by 5 inches by 1/8 inch wall thickness. Provide a minimum 0.4-mil-thick anodized 204R1 finish. All doors shall have manufacturer's standard 24-inch-by-34-inch-by-1/4-inch thickness tempered glass and aluminum framed windows mounted in the doors' upper halves. The lower halves of the two doors for the Ammonium Sulfate Storage and Feed Facility modular precast concrete building shall have the manufacturer's standard aluminum framed and slat-type angled louvers with removable insect screens fixed in frames attached to the interior face of the door completely covering the louver slats. Provide Series 100 BE doors as manufactured by Cline Aluminum Products, Bradenton, Florida or approved equal.

B. Provide frames and thresholds manufactured from 6063-T5 extruded aluminum alloy. Factory drill and mortise hinges and strike plates. Drill and tap to receive finish hardware. Provide an anodized 204R1 finish. Provide frame and threshold seals and weather strip molding.

C. Provide 4-1/2-inch-by-4-1/2-inch stainless steel, full mortise, button type, ball bearing hinges. Provide surface mount, vertical rod type interior exit devices. Provide interior knob-type and exterior automatically locking knob. Key all locksets to the Owner's system. Provide Russwin Exiter Series 700 units, or approved equal.

2.06 EQUIPMENT AND FURNISHINGS

A. Provide air-conditioning equipment for each electrical building as follows:

1. Electrical Building 1:

a. Provide two identical units, wall mounted, 3 tons, cooling only, 208V, 1 phase, stainless steel exterior housing, factory thermostat, supply and return air grilles, and filters as manufactured by Bard or equal.

2. Electrical Building 2:

a. Provide two identical units, wall mounted, 2 tons, cooling only, 208V, 1 phase, stainless steel exterior housing, factory thermostat,

supply and return air grilles, and filters as manufactured by Bard or equal.

2.07 DOORS

A. Provide one 3-foot-0-inch-by-7-foot-0-inch double door, and one 3-foot-0-inch-by-7-foot-0-inch single door, manufactured from 6063-T5 aluminum alloy extruded tube measuring 1 3/4 inches by 5 inches by 1/8 inch wall thickness. Provide a minimum 0.4 mil thick anodized 204R1 finish. Provide Series 500 BE doors as manufactured by Cline Aluminum Products, Bradenton, FL, or approved equal.

B. Provide frames and thresholds manufactured from 6063-T5 extruded aluminum alloy. Factory drill and mortise hinges and strike plates. Drill and tap to receive finish hardware. Provide an anodized 204R1 finish. Provide frame and threshold seals and weather strip molding.

C. Provide 4-1/2-inch-by-4-1/2-inch stainless steel, full mortise, button-type ball bearing hinges. Provide surface mount, vertical rod type exit devices. Provide interior knob-type and exterior automatically locking lever. Key lockset to Owner's system. Provide Russwin Exiter Series 700 units, or approved equal.

D. A removable transom shall be installed above the double doors. The transom shall be 2 feet high by width of pair of doors. When the transom is removed and the doors are open, the opening shall be a minimum of 9 feet high and 6 feet wide clear for installing equipment. The transom shall be the same material and thickness as the door.

2.08 SPECIAL CONSTRUCTION

A. Each precast concrete building shall be provided with cutouts located below the motor control centers, switchgear, freestanding variable frequency drives, and control cabinets for installation of all cables and conduit of the equipment located outside the building. Refer to the drawings for the location of the equipment. Coordinate cutout locations with the Contractor.

B. Contractor shall be responsible for filling the cutouts with non-shrink grout upon completion of installation of cables and conduits through the cutouts.

2.09 PAINT

A. All colors shall be selected by the Owner. Contractor shall submit building manufacturer's standard paint color chart for Owner color selection. Paint shall be

in conformance with Section 09900, Painting and Coating. Paint Color Sample Sheet shall be submitted for final color selection.

2.10 SEALANT

A. Nonsag sealants (N/S) shall be used for all joints, whether horizontal or vertical. Primer shall be the type recommended by the sealant manufacturer.

B. Color shall match the color of the unpainted finished exposed surfaces.

C. The sealant shall be PRC 150, PRC 250, Vulkem 116, Vulkem 4, Sikaflex 1a, Isoflex 2000 or equal.

2.11 FIRE EXTINGUISHER

A. Provide each building with one UL Classification 2-10-B, C; 10-pound carbon dioxide fire extinguisher complete with pressure/fill gauge and wall mounting bracket. Mount fire extinguisher on interior wall of building.

2.12 PAINT

A. Provide exterior with acrylic enamel or acrylic latex in the Owner's selected colors. Apply one primer coat of Carboline "Flexide" Masonry Block Filler to fill all voids, pores, and cracks; ICI Devoe Bloxfill 4000; Amerlock 400 BF; Tnemec 54-562 Masonry Filler single component epoxy; International Intercryl 320WB; Sherwin-Williams Heavy Duty Block Filler B42W46 at 10.0 to 18.0 mils DFT; PPG SPEEDHIDE® Int/Ext Acrylic Masonry Block Filler 6-15; or equal. Apply two finish color coats of Carboline 3350, two coats of ICI Devoe 4208, two coats of Ameron 220, two coats Tnemec Series 6 at 2.0 to 3.0 mils per coat, two coats of International Intercryl 530WB 520, two coats of Sherwin-Williams Metalatex Semi-Gloss B42 series at 2.0 to 4.0 mils DFT/coat, two coats of PPG Int/Ext Semi-Gloss Acrylic Metal Finish 7-374 Series, or equal.

PART 3 EXECUTION

3.01 BUILDING FOUNDATION AND FLOOR SLAB

A. Prior to delivery of building, the building's concrete slab shall be constructed by the Contractor in accordance with the Structural Drawings and coordination with the Contractor. All conduits and piping shall be installed at the depths required, and extended to a minimum of 18 inches above the finished floor elevation. The placement and location of these pipes and conduits is of the utmost importance, as openings are cast in the floor slab of the building for said pipes and conduits.

Once the concrete slab is constructed, the Contractor shall contact the building manufacturer for a site inspection prior to building placement.

3.02 SHIPMENT TO JOB SITE

A. The building shall be shipped by special over-the-road equipment with air suspension to minimize the stresses applied during shipment. The building shall be provided with hooks for lifting without damage to walls, roof, or floor. The building manufacturer shall be responsible for delivery of building and shall provide a representative at time of shipment, to measure and check locations of the floor blockout openings, core additional blockout openings if approved, and unload and set building in place. Building shall be set level, and finish painting, sealing, final touch-up completed by the representative, if necessary.

3.03 ASSEMBLY

A. Buildings small enough to be shipped in one piece shall be entirely assembled by the manufacturing plant, sealed, waterproofed and tested for water tightness. The building shall be manufactured with a mechanism for assembly under tension at the factory, and provided with joints to be caulked with a sealant to maintain a permanent seal under severe weather conditions. All joints shall be caulked and sealed. Buildings too large to be shipped by truck shall be assembled on site. All provisions for assembly at the manufacturing plant apply to assembly onsite.

3.04 BLOCKOUT GROUT FILL

A. Fill and finish smooth penetrations and block-outs (except at block-outs for air-conditioning units) in the floor and walls with concrete or non-shrink grout to match top of building's finished floor. Match grout fill finish to building floor finish.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representatives at site for installation assistance, inspection, and certification of proper installation, equipment testing, startup assistance, and training of Owner's personnel for specified component, subsystem, equipment, or system. The building manufacturer shall be responsible for delivery of the building and shall provide representative to offload and set building in place. For each building the building manufacturer's representative shall be present at the site for at least 1 person-day, travel time excluded, for installation inspection, check-out, clean-up, and certification.

3.06 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on moving and operating components.

B. Electrical Continuity: Test continuity of completed structure and installed equipment to ground.

3.07 CLEANING/ADJUSTING

A. Adjust moving and operating components for smooth operation.

B. Thoroughly clean interior and exterior of building and leave weathertight and ready for use.

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION
MODULAR PRECAST CONCRETE BUILDING

OWNER _____
EQPT SERIAL Nos.:_____
PROJECT NO.:_____ SPEC. SECTION: 13100

I hereby certify that the Contractor performed the installation requirements, checked below, for the equipment referenced above.

☐ Installed in accordance with Manufacturer's written instructions and recommended methods.

☐ Inspected, functionally tested, and adjusted all equipment as necessary.

☐ Electrical connections meet NEC quality and safety standards.

☐ Installed applicable safety equipment in accordance with Manufacturer's written instructions.

☐ Executed performance testing confirming specified performance requirements.

Comments:_____
_____
_____
_____

I, the undersigned Manufacturer's Authorized Representative, certify that I am a duly authorized and empowered to inspect, approve, and certify the manufacturer's equipment is complete and properly installed, except as may be noted above. I further certify all information contained herein is true and accurate to the best of my knowledge.

Manufacturer:_____

Manufacturer's Authorized Representative (Print):_____

Signature: _____Date:_____, 20___

END OF SECTION

SECTION 13120
PRE-ENGINEERED METAL BUILDING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to design, fabricate, deliver to the project site, and erect the pre-engineered building as shown on the Drawings and as specified in this Section. The building shall be named *Chemical Feed Building*.

B. Material furnished shall include the structural framing, connections, anchor bolts, framed openings for roof penetrations, and framed openings for doors; metal roofing, metal siding, metal curbs, pipe flashing, gutters, downspouts, gable trim, flashing, closures, fasteners, sealants, and all other component parts for a complete Pre-Engineered Metal Building.

C. All materials shall be new, fabricated in a workmanlike manner, and free of defects.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit to the Engineer complete drawings showing superstructure column lines set to coordinate with concrete dimensions shown. Indicate anchor bolt size and locations and foundation reactions in KIPS at all columns.

B. Submit product information, specifications, and installation instructions for all components and accessories proposed.

C. Submit shop drawings and complete erection drawings for review, including:

1. Anchor bolt and base plate settings.
2. Sidewall, end wall, roof framing, and bracing.
3. Transverse cross-sections and details of openings, covering, and trim.

D. Records

1. Furnish the Engineer with the following records:

a. A letter signed and sealed by a Professional Engineer registered in the Florida certifying that the structural framing and covering panels proposed meet the design criteria set forth by the Engineer.
b. Two sets of design calculations signed and sealed by a Professional Engineer registered in Florida.
c. One set of reproducible record erection drawings.

E. Samples

1. Two each of the following samples shall be submitted for approval of materials, finish, color, and texture:

a. Full panel width by a minimum 12-inch-long roofing and wall panels in proposed colors and finish.
b. Minimum 12-inch-long formed sections of gutter, gutter tailpiece, gable trim, and flashings in proposed colors and finish.
c. Each proposed fastener.
d. Sealants and closures.

F. Color Charts

1. Submit standard the manufacturer's color charts for initial color selection.
2. Colors shall be selected by the Engineer and the Owner.

G. Signed and sealed drawings and design calculations shall be submitted to the Engineer for approval before erection.

H. Submit the building manufacturer’s welder certifications.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A792/A792M—Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

B. The Society for Protective Coatings (SSPC)

1. SSPC SP-6—Commercial Blast Cleaning.
2. SSPC SP-8—Pickling.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. Provide a 1-year warranty for all furnished components except provide a 20-year warranty for wall and roof panels. Provide a 20-year extended-life endorsement and a 10-year weathertightness endorsement for furnished metal curbs, and provide a full 20-year weathertightness endorsement for roof panels.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver, store, and handle prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal sheets or panels so that water accumulations will drain freely. Do not store sheets or panels in contact with other materials which might cause staining.

PART 2 PRODUCTS

2.01 GENERAL

A. The design of the structural system for the Building is to be clear-span rigid-frame with tapered columns, tapered roof beams, and a gable roof.

B. The actual building length and building width shall be structural line to structural line, incorporating nominal bays and widths in the manufacturer's standard sizes.

C. The roof shall be sloped as shown on the Drawings.

D. All components and parts of the structural system shall be as indicated on the Drawings and in this Section of the Specifications.

E. All components and parts shall be clearly marked.

F. Erection Drawings, signed and sealed by a Professional Engineer registered in Florida, shall be supplied for identifying and assembling parts.

G. Field modification shall be in accordance with the best standard procedures and to be the responsibility of the building erector.

H. All reactions for the foundation design are to be supplied by the pre-engineered building manufacturer before the building foundation shop drawing is submitted.

I. The foundation sizing and reinforcement details are to be based on the manufacturer's building details and are to be compatible with the reactions, loadings, stresses, and column locations supplied by the pre-engineered building manufacturer. The foundation sizing and locations as shown on the Drawings are preliminary and have been based on realistic reactions for the building dimensions and loadings specified in this Section. The cost for any required amendments to the foundation material quantities as shown on the Drawings shall be a subsidiary obligation of the Contractor and shall not result in any additional cost to the Owner.

J. Anchor bolt locations, size, and quantity shall be designed by the building manufacturer and supplied by the Contractor. Embedment lengths shall be as called for in the shop drawing review and no less than 12 inches.

2.02 DESIGN CRITERIA

A. Primary and secondary members and covering shall be designed for all applicable loads and combinations of these loads as set forth in the MBMA *Recommended Design Practices Manual*, as required by the governing building code and as specified in this Section. Roof system shall have a UL wind uplift Class 90 rating.

B. The design shall allow for concentrated loads for equipment attached to the building structure as shown on the Drawings and for the dead load of the structure itself.

C. Column reactions shall be vertical and horizontal only. No bending moments will be allowed at the column bases.

D. The design, fabrication, and erection of the building shall conform to the applicable sections of the latest edition or revision of the following codes and standards:

1. American Institute of Steel Construction:

a. Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

2. American Iron and Steel Institute:

a. Specifications for the Design of Cold-Formed-Steel Structural Members.
b. Design of Light-Gauge-Steel Diaphragms.

3. American Welding Society:

a. Structural Welding Code.

4. Metal Building Manufacturer's Association:

a. Recommended Design Practices Manual.

5. American Society of Testing and Materials:

a. Material designation as specified in this Section by ASTM number.

2.03 MATERIAL (FRAMING)

A. Primary Framing

1. Rigid Frames:

a. Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.

b. Welding shall be done in accordance with the American Welding Society Code for Building Construction.

(1) Certification of welder qualifications are to be supplied.

c. All base plates, cap plates, compression plates, and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.

d. All splice plates shall be shop fabricated complete with bolt connection holes.

e. Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing.

2. All bolts for field assembly of frame members shall be high-strength bolts as indicated on erection Drawings.

3. Endwall Structurals:

a. Endwall frames shall consist of endwall corner posts, endwall roof beams, and endwall posts as required by the design criteria.

(1) All splice plates and connection clips shall be shop fabricated complete with bolt connection holes.
(2) Beams and posts shall be shop fabricated complete with holes for the attachment of secondary structural members.

B. Secondary Structural Members

1. Purlins and Girts:

a. Purlins and girts shall be 9-1/2-inch-deep "Z" sections, precision roll formed.
b. Outer flange of all purlins and girts shall contain factory-punched holes for panel connections.

2. Eave Struts:

a. Eave struts shall be 12-inch-deep "C" sections.
b. Outer flange of all eave struts shall contain factory-punched holes for panel connections.

3. Bracing:

a. Diagonal bracing or portal frames shall be designed by the building manufacturer and attached to columns and roof beams. Coordinate all bracing with mechanical before completing shop drawings.

b. Flange braces, sag angles, etc., when required, shall be supplied by the building manufacturer.
c. All bracing locations shall be coordinated with ductwork, piping, door openings, and ventilation openings.

C. Structural Painting

1. Primary Frames: Clean all steel in accordance with SSPC SP-6. Apply one coat of Tnemec Series 90-97 Tneme-zinc at a dry film thickness of 2.5 to 3.5 mils.

2. Secondary Structurals: Clean all steel in accordance with SSPC SP-8. Apply one coat of coil-applied polyester primer to a minimum coating thickness of 0.5 mil (purlins and girts).

3. Finish Paints System (Primary Frames and Secondary Structurals):

a. First Coat: Tnemec Series 66HB Epoxoline (or equal) with a dry film thickness of 3.0 to 5.0 mils.
b. Second Coat: Tnemec Series 1075 Endurashield (or equal) with at dry film thickness of 2.5 to 4.0 mils.

2.04 MATERIAL (ROOF SYSTEM)

A. General

1. The building roof panels shall be precision roll formed MR-24 panels.
2. Details shall be in accordance with the manufacturer's drawings.
3. Installation shall be in accordance with the manufacturer's drawings.

B. Panel Description

1. Panels shall be roll formed to provide a width coverage of 24 inches.

a. There shall be two major corrugations, 2 inches high, spaced 24 inches on center.
b. There shall be minor corrugations, spaced 6 inches on center between and perpendicular to the major corrugations.

2. The panel endlaps shall be 6 inches.

a. Panels shall be of maximum length so as to minimize panel endlaps.

b. Endlaps shall be engineered to occur over and be fastened to a secondary structural member.
c. The upper end of all panels shall be marked for the proper location of endlap sealant.

3. Ridge assembly shall be designed to allow for expansion and contraction.

4. Eave panels shall extend beyond the building structural line.

5. Panels shall be factory pre-punched at panel ends to match pre-punched holes in the eave structural members. Panel end splices shall be factory pre-punched and pre-notched. Panel end splices shall allow for expansion and contraction of the panels.

6. Panel Material and Finish:

a. 24-gauge minimum steel, coated both sides with a layer of Galvalume aluminum-zinc alloy (approximately 55% aluminum, 45% zinc) applied by the continuous hot dip method. Minimum 0.55-ounce coated weight per square foot as determined by the triple-spot test according to ASTM A792/A792M.

C. Panel Design

1. Panel design shall be in accordance with Paragraph 2.02 of this Section.
2. Panel design shall provide for expansion and/or contraction as caused by an ambient temperature range of 120ºF without causing harmful buckling, opening of joints, and other detrimental effects.

D. Fasteners

1. Bearing plates and panel clips shall be fastened to structural members with fasteners as in the manufacturer's erection drawings, using factory pre-punched holes in structural members.
2. All connections of MR-24 panels to structural members except at eave shall be made with clips with moveable tabs that are seamed into the standing seam sidelap.
3. Panel clips shall be fastened to structural members with fasteners according to the manufacturer's erection drawing, using factory pre-punched holes in structural members.
4. MR-24 panel-to-panel connections shall be made with a positive, field-formed standing double-lock seam.

E. Accessories

1. Location of standard accessories on the erection drawings as furnished by the manufacturer. Accessories shall be installed in accordance with the manufacturer's instructions and as shown on the Drawings.

    a. Metal curbs and pipe flashings shall be manufacturer standard except that interior faces of curbs must be fully enclosed also.
    b. Gutters, downspouts, and trim pieces shall be standard manufacturer products installed in accordance with manufacturer's instructions and as shown on the erection drawings.
    c. All miscellaneous trim, gutters, downspouts, and accessories are to match adjacent panel colors.

F. Panel Application

1. All panels shall be factory cut-to-length according to the erection drawings as furnished by the manufacturer.
2. All panels shall be positioned and aligned to hold the 24-inch module throughout the building length.
3. Pre-punched panels shall be positioned and aligned by matching the pre-punched holes in the panel with the pre-punched roof structurals.
4. Panel sidelaps shall be field seamed; all sidelap sealant shall be factory applied.
5. All endlaps will be at least 6 inches and fastened together over and to structural members.
6. All panel sidelaps and endlaps shall be sealed with weather sealing compound to prevent the entry of capillary moisture.
7. Fasteners shall be installed with proper tools in a workmanlike manner according to the recommendations of the manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. The pre-engineered building shall be erected on the site as indicated on the Drawings.

B. The pre-engineered building shall not be fabricated or erected until:

1. Structural loadings required in this Section supplied by the building manufacturer have been approved by the Engineer.
2. The foundation design and details based on the structural loadings have been approved by the Engineer.

C. The pre-engineered building shall not be erected until the foundation work, the concrete floor slab, plumbing, and other incidentals required to be built before the building installation have been approved by the Engineer.

D. The pre-engineered building shall not be erected until sufficient components of the building to enable a stable structure to be erected are on site.

E. The Contractor is responsible for ensuring that all safety procedures for the erection of the building are strictly enforced and that any required ties, stays, and temporary works are positioned as necessary to keep the structure stable and secure at all times.

F. All installation of the building shall be to the manufacturer's instructions and requirements.

G. The building manufacturer shall provide all necessary framing details to the openings in the walls, roofing, and other components where shown on the Drawings. The cost of all such framing shall be included in the installed cost of the pre-engineered building.

H. The building manufacturer shall provide, at no additional cost to the Owner, all necessary repair and touch-up work required as a result of damage to building components due to required cut-outs, penetrations, or by mishandling before and during erection.

END OF SECTION

SECTION 13125
PRE-ENGINEERED FIBERGLASS BUILDINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to furnish and install one, pre-engineered fiberglass building to serve as enclosures for the Analyzer Building as shown on the Drawings. The Contractor shall furnish and install all building components and accessories specified in this Section, including but not limited to the following: Pre-engineered fiberglass buildings, electrical wiring and devices, lighting (interior and exterior), and ventilation equipment for pre-engineered structures.

B. The Contractor shall coordinate the location of all building underslab piping and conduit (if any), other utility services, carbon and polymer feed systems, instrumentation analyzers and compressor specified in other sections of these Specifications and as shown on the Drawings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit the manufacturer's instructions for erecting the pre-engineered fiberglass buildings, indicating the recommended installation methods, connection details, and sequencing.

B. Submit fabrication drawings for the pre-engineered fiberglass buildings. Fabrication drawings shall be signed and sealed by a Florida-registered professional structural engineer.

C. Shop Drawings: Fabrication and installation drawings shall be submitted for the following items.

1. Fiberglass primary and secondary members, roofing and siding, accessories, ventilators and louvers, gutters and downspouts. Size and thickness of all fiberglass members shall be included on shop drawings.
2. All connection details to the supporting concrete slab shown on the Drawings, including all anchors. Coordinate final concrete slab dimensions with the Contractor before construction.
3. Building reactions along bearing walls and/or columns.

D. Submit certificates for the materials, equipment, and accessories specified in this Section showing conformance with the referenced standards contained in this Section.

E. Samples: The Contractor shall provide the following samples:

1. Manufacturer's Standard Color Charts shall be submitted in accordance with Section 01330, Submittals and Acceptance.

F. Peripherals: The Contractor shall submit the manufacturer's detailed drawings, data and installation, operation, and maintenance literature for the following building peripherals:

1. Door, Frame, and Hardware.
2. HVAC.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C518—Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
2. ASTM D256—Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
3. ASTM D476—Standard Classification for Dry Pigmentary Titanium Dioxide Products.
4. ASTM D638—Standard Test Methods for Tensile Properties of Plastics.
5. ASTM D732—Standard Test Method for Shear Strength of Plastics by Punch Tool.
6. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
7. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
8. ASTM D1622—Standard Test Method for Apparent Density of Rigid Cellular Plastics.
9. ASTM D2583—Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

10. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection association (NFPA)

1. NFPA 70—National Electrical Code (NEC).
2. NFPA 110—Life Safety Code.

C. Underwriters Laboratories, Inc. (UL)

1. UL 67—Panelboards.
2. UL 83—Thermoplastic Insulated Wires and Cables.
3. UL 467—Grounding and Bonding Equipment.
4. UL 489—Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
5. UL 514C—Nonmetallic Outlet Boxes, Flush Device Boxes, and Covers.
6. UL 651—Schedule 40 and 80 Rigid PVC Conduit and Fittings.
7. UL 1449—Surge Protective Devices.
8. UL 1660—Liquid-Tight Flexible Nonmetallic Conduit.

1.04 QUALITY ASSURANCE

A. The manufacturer shall have a minimum of 5 years' experience fabricating pre-engineered fiberglass buildings.

B. The manufacturer shall provide a letter signed by a manufacturer's representative certifying compliance with these Specifications.

C. Upon the Engineer's request, the manufacturer must provide proof or evidence of facilities, equipment, experience, and capability required to fabricate the specified building.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, fiberglass buildings, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for 1 year. The warranty period shall begin at the date of substantial completion.

C. The warranty shall cover replacement equipment materials, parts, and/or repair, including labor, travel time, shipping costs, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 DESIGN CRITERIA

A. Design shall be in accordance with Florida Building Code (FBC) 2014. Buildings shall be designed to withstand roof live load and wind loads in accordance with FBC 2020. Ultimate design wind speed shall be in accordance with ASCE 7-16 and as stated in the Structural Drawings.

B. Deflection of roofing and siding panels shall not exceed 1/180 of the span on single-span loading under live and wind loads.

1.08 ANCHOR BOLT SYSTEM

A. Anchor bolts connecting the building to the slab shall be stainless-steel expansion anchors provided by the pre-engineered fiberglass building manufacturer. The Contractor shall coordinate required anchor bolt size, embedment depth, and locations with the pre-engineered fiberglass building manufacturer before pouring the concrete slab shown on the Drawings.

PART 2 PRODUCTS

2.01 GENERAL

A. The pre-engineered fiberglass buildings shall be free-standing structures with the minimum outside dimensions as follows and as located on the Drawings:

1. Analyzer Building: 14 feet-6 inch wide x 19 feet-6 inch wide x 8 feet-6 inches high.

B. The Contractor shall verify that the internal plan area and building height are sufficient for their intended use before installing the buildings.

C. The building shall be factory pre-assembled composite building.

D. The entrance door of each building shall be prominently marked with a fiberglass laminate 18-inches-x-18-inches (minimum) sign stating as follows:

ANALYZER BUILDING

2.02 FIBERGLASS BUILDING MATERIALS

A. Molded composite: Exterior and interior resin-fiberglass laminate with foam core.

1. Laminate: Polyester resin and chopped strand fiberglass; minimum glass content of 25%.

a. Exterior surface: Gel coat with low-luster finish, smooth and free from fiber pattern, roughness, or other irregularities.

b. Exterior laminate: 1/8-inch thick, minimum, chemically bonded to gel coat.

c. Interior laminate: White color, encapsulate core in place. Interior laminate shall be 1/8-inch thick, minimum.

d. Laminate properties:

(1) Tensile strength (ASTM D638): 11,000 psi.
(2) Flexural strength (ASTM D790): 18,000 psi.
(3) Shear strength (ASTM D732): 12,000 psi.
(4) Barcol hardness (ASTM D2583): 40.
(5) Impact (ASTM D256): 12 ft lb/inch.
(6) Heat Distortion Point (ASTM D476): 175ºF.
(7) Density/specific gravity (ASTM D792): 93.6 PCF/1.5.
(8) Surface burning characteristics (ASTM E84):

(a) Flame spread, less than 150; smoke density, less than 1,000.

2. Core:

a. Rigid closed-cell, self-extinguishing, polyisocyanurate foam with a density of 2.0 pounds per cubic foot.

(1) 2 inches thick with a minimum insulating value of R 14.

b. Core Properties:

(1) Thermal conductivity (ASTM C518): 0.13 BTU inch/hour SF F.

(2) Density/specific gravity (ASTM D1622): 2.0 PCF/.03.

(3) Surface burning characteristics (ASTM E84):

(a) Flame spread, 35; smoke density, 240.

B. The manufacturer shall maintain a continuous quality-control program and shall furnish certified test results of the physical properties of the material in this Section to the Engineer upon request.

2.03 BUILDING EXTRUSIONS AND REINFORCEMENT

A. Encapsulated aluminum extrusion 4 inches wide by 2-1/2 inches high by 0.125-inch thick with a 1-inch-wide side flange shall be encapsulated into each corner of end panels (full height) and around the entire roof perimeter to maintain flatness, straightness, and structural integrity. Integral internal flanges on mating panels shall be provided for bolting the sides, ends, and roof to the encapsulated aluminum extrusions.

1. Aluminum extrusions: Incorporate threaded inserts on 12-inch centers for internal bolting to mating panel flange during assembly.

2. Assemble panels with 3/8-inch-diameter Type 316 stainless steel bolts on 12-inch centers and a 1/4-inch-thick-by-3-inch-wide urethane foam gasket for a weather-tight seal at all joints. Assembly bolts shall not penetrate the exterior wall of the structure.

3. Wall and roof panels shall be structurally reinforced with encapsulated steel and aluminum extrusions to meet load conditions.

a. Galvanized steel mounting channel reinforcement shall be 0.078-inch thick by 13/16-inch high by 1-5/8-inch wide and mechanically attached to the interior surface with aluminum pop rivets on 12-inch centers on all walls.
b. Steel reinforcement shall be 1/4-inch-thick-by-1-1/2-inch-wide structural angle.
c. Aluminum reinforcement shall be extruded channel sections 3-inches wide by 1-1/2-inches high by 0.125-inch thick with a 1-inch-wide side flange as required.

4. Molding shall be a continuously formed one-piece molded composite wall or roof panel with the specified encapsulated aluminum and steel reinforcements.

5. The wall panels shall have an integral 4-inch-wide internal mounting flange pre-drilled on 12-inch centers with 5/8-inch-diameter holes for attaching to concrete slab.

2.04 DOORS AND HARDWARE

A. Provide a 36-inch-x-84-inch double door each for the Analyzer Building and the Compressor Building and two 36-inch-x-84-inch double doors for the Carbon and Polymer Feed Building (one on each end). Each door shall be one-piece molded, fiberglass composite, a minimum 1-3/8-inch thick, and typical of wall materials of construction.

B. The door shall be mounted using a continuous stainless steel hinge. The door shall be provided with a one-point keyed stainless steel latch and cadmium-plated door stop with chain. The door shall have a 12-inch-x-12-inch (minimum) safety glass window for viewing inside the building.

C. The door gasket shall be extruded from closed cell neoprene sponge rubber and shall provide a weather-tight seal.

2.05 ACCESSORIES FOR EACH FIBERGLASS BUILDING

A. Anchor Bolts: 1/2-inch-diameter AISI Type 316 stainless steel expansion anchors.

B. Lifting Bolts: Provide a minimum of two 3/4-inch-diameter steel lifting eye bolts in the roof. Each eye bolt shall be removable and shall be able to lift the weight of the entire pre-engineered fiberglass building.

C. Hardware: All hardware and fasteners used to install the pre-engineered fiberglass building accessories specified in this Section shall be AISI Type 316 stainless steel.

D. Provide air-conditioning equipment as follows:

1. Provide one unit, wall mounted, 3 tons, cooling with 5kW heater, 208V, 1 phase, stainless steel exterior housing, indoor and outdoor coils coated, factory thermostat, 25% fresh-air damper with exhaust, supply and return air grilles, and filters as manufactured by Bard or equal.

E. Color: Owner selected.

2.06 PRE-ENGINEERED FIBERGLASS BUILDING MANUFACTURERS

A. Warminster Fiberglass Inc.
B. Midwestern Fabricators.
C. Or Engineer-approved equal.

PART 3 EXECUTION

3.01 ERECTION

A. Before erecting the building, the Contractor shall verify the elevations and locations of concrete surfaces and locations of anchor bolts for compliance with the requirements of the fiberglass building system manufacturer's tolerances.

B. Install fiberglass buildings according to the manufacturer's written installation instructions and drawings.

C. Ground the building in accordance with Article 250 of the NEC.

D. Test and balance the HVAC system.

3.02 ACCESSORY INSTALLATION

A. General: The Contractor shall install accessories with positive anchorage to the building and weathertight mounting and provide for thermal expansion. Coordinate installation with other building components and accessories to avoid interferences.

B. Door: After completing installation, test and adjust the door to ensure it operates easily and is free of warp, twist, or distortion.

3.03 CLEANING AND PROTECTION

A. Replace all fiberglass building components damaged during building installation at no expense to the Owner.

3.04 COORDINATION

A. The Contractor shall verify concrete pad plan dimensions to suit all buildings specified in this Section before forming and pouring concrete pads. The Contractor’s failure to verify dimension before installing the building shall require a new concrete pad at the Contractor’s sole expense.

B. Concrete pad foundations and floor are to be constructed generally as shown on the Drawings and specified elsewhere. The portion of the pad serving as the

building floor shall be level with the remainder of the pad draining from the building at a constant slope.

C. The Contractor shall provide PVC power and signal conduit, fittings, non-metallic conduit straps, stainless steel fasteners, and conductors as requested from the building electrical panel to the skid-mounted sodium hypochlorite feed system.

END OF SECTION

SECTION 13127
MOBILE OFFICE/LAB TRAILER

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install one mobile office/lab trailer as described by this Section. The trailer shall be located as shown on the Drawings. The trailer shall serve as an office and laboratory building at a domestic wastewater treatment plant site. The Contractor is responsible for providing a foundation and wind loading tie-down restraint system design signed and sealed by a Florida-registered professional engineer meeting all requirements of the Florida Building Code and local ordinances.

B. The Contractor shall obtain and furnish to the Owner all state and local permits required to furnish and install the mobile office/lab trailer.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit the manufacturer's detailed drawings and descriptions for the Mobile Office/Lab Trailer, including all peripherals (i.e., fan, water heater, heat pump system, appliances, wiring diagrams, electrical panelboard schedule, etc.). Submittals shall be prepared in accordance with Section 01330, Submittals and Acceptance.

C. The Contractor shall submit signed and sealed drawings from a professional engineer licensed in the State of Florida for the trailer foundation and tie-down restraint system

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Disabilities Act (ADA)

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

1. ASHRAE 90A—Energy Conservation in New Building Design/

C. Florida Building Code (FBC)

D. National Fire Protection Association (NFPA)

1. NFPA 70—National Electrical Code.

E. Columbia County Local Ordinances

F. Department of Community Affairs (DCA)

1.04 QUALITY ASSURANCE

A. The manufacturer shall have a minimum of 5 years' experience constructing trailers.

B. The manufacturer must demonstrate proof of financial responsibility with respect to trailer delivery and performance.

C. The manufacturer shall provide a letter signed by a manufacturer's representative certifying compliance with these Specifications.

D. Upon request from the Engineer, the manufacturer must provide proof or evidence of facilities, equipment, and capabilities required to produce the specified trailer.

E. The mobile office/lab trailer shall meet or exceed all applicable state and local building code requirements and certifications.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for 1 year. The warranty period shall begin at the date of substantial completion.

C. The warranty shall cover replacement equipment materials, parts, and/or repair, including labor, travel time, shipping costs, and other miscellaneous expenses, at no additional cost to the Owner for the full warranty period.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

B. Submit operations and maintenance manuals for the all equipment and other installed miscellaneous factory manufactured equipment in compliance with the Contract Documents before shipment. Manuals shall be in accordance with Section 01330, Submittals and Acceptance, and Section 01830, Operations and Maintenance Manuals.

1.07 AMERICAN DISABILITY ACT COMPLIANCE

A. Access from the exterior finished grade to the interior and access within all interior spaces of the trailer shall be compliant with the requirements of the American Disability Act (ADA).

PART 2 PRODUCTS

2.01 TRAILER

A. The trailer shall be a freestanding structure 60 feet long by 12 feet wide by 8 feet tall. A preliminary layout plan of the trailer is shown in Figure 1 included in this Section.

B. The trailer shall be designed in accordance with the regulatory requirements pertaining to Columbia County, Florida, including but not limited to the current edition of the following regulations:

1. Florida Building Code.
2. ASHRAE 90A, Energy Conservation in New Building Design.
3. NFPA 70, National Electric Code.
4. Columbia County Local Ordinances.
5. Department of Community Affairs (DCA).

The manufacturer shall furnish a certificate of compliance with the codes and ordinances referenced above, signed and sealed by a professional engineer registered in the manufacturer's state. The manufacturer shall also provide the Florida Department of Consumer Affairs' approval for the submitted plans.

C. Requirements for the frame, floor, wall, and partitions are given in Table 1.

D. Requirements for the roof, insulation, and plumbing are given in Table 2.

E. Requirements for electrical are given in Table 2. Provide electrical wiring, conduit, components, outlets, and electrical panelboard meeting the requirements for the restroom, laboratory, and office lighting and power receptacles, heating and cooling system, water heater, and other miscellaneous electrical loads, and as shown in the Contract Drawings. The electrical panelboard shall be 240/120 volts, single phase, three-wire, with a 125-Ampere copper bus. The panelboard shall include a 125-amp main circuit breaker and a minimum of 20 single-pole circuits and shall include the required number and size of branch circuit breakers. All power receptacles shall be ground fault protected by GFCI breakers.

F. Requirements for the HVAC, exterior of the trailer, cabinets, and sink/fixture are shown in Table 3.

G. The building manufacturer shall be United Rental of Jacksonville, Florida, or equal as approved by the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION INSTRUCTIONS

A. Work shall be performed in accordance with the manufacturer's written instructions and installation detail drawings.

B. The site shall be flat and accessible. The soil beneath the trailer shall be compacted to 2,000 pounds per square foot.

C. The trailer shall be supported by a foundation and wind-load restraint tie-down system designed by a Professional Engineer licensed in Florida.

D. The Contractor shall furnish and install a restraint system to tie-down the trailer. The tie-down system shall meet the design wind loads required in the State of Florida Statutes and Building Codes. This system is to be determined by the licensed Florida Professional Engineer and integrated with the foundation design and included in the required submittal.

E. The Contractor shall make all connections, including but not limited to potable water, sewer, communications, and electrical service for the trailer. All communications lines shall have solid-state surge suppression.

F. The Contractor shall locate, independently mount, and support all non-trailer manufacturer supplied electrical panels, instruments, and controls, as indicated in the Drawings and as specified in these Contract Documents.

G. An ADA-compliant handicapped-accessible ramp shall be constructed for the trailer using pressure-treated wood. Main vertical supports for the ramp shall be 4 inches by 4 inches, minimum. All other members shall have a minimum thickness of 1 inch. The top landing of the ramp shall be 60 inches long and 48 inches wide. The ramp shall have a handrail. The top rail shall be 34 to 38 inches high and the bottom rail shall be no more than 27 inches high. The handrails (both top and bottom) shall be extended 18 inches beyond the bottom of the ramp. A 48-inch-by-72-inch concrete pad shall be constructed at the bottom of the ramp and will be flush with finished grade.

H. The trailer shall be underpinned using painted metal vented skirting. The skirting shall have a door installed to allow for access beneath the trailer.

I. Obtain all local permits and certificates of occupancy permits required for the Work specified in this Section.

Figure 1 Mobile Office/Lab Trailer – Plan

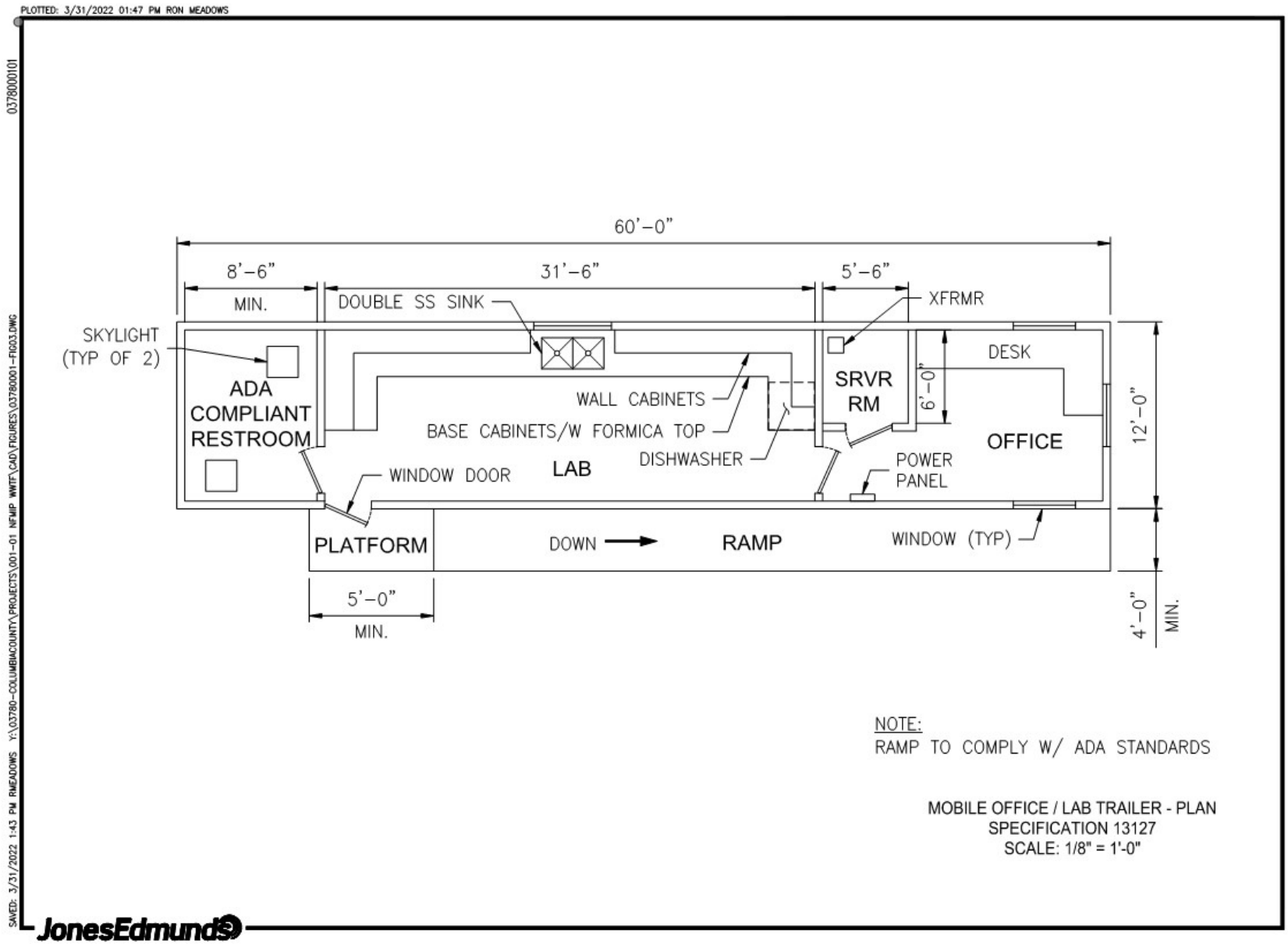


Table 1 Requirements for Frame, Floor, and Walls and Partitions	
Building Size	12 feet × 60 feet (outside dimensions)
Frame	
Hitch	Removable
Axles	Two (minimum)
Jr. 1 Beam	10 inches min.
Type	Outrigger 48 inches on center min.
Wind Design	As required by code, minimum 130 mph
Floor	
Joist	2-inch x 8-inch SYP #2, 16 inches O.C.
Decking	3/4-inch Plywood T&G – Single Layer
Floor Covering	1/8-inch vinyl block tile
Carpet	None
040 Asphalt Vapor Barrier	Provide
Walls and Partitions	
Interior Wall Height	8 feet-0 inch
Studs	2-inch x 4-inch, 16 inches O.C.
Top Plate	Double
Wall Covering	VCG (Vinyl-Covered Gypsum)
Molding Package	Standard VCG Trim Package
Interior Doors	(1) 36-inch x 80-inch, Pre-finished, Pre-hung, Glass kit, Privacy Lock hardware (1) ADA-Compliant Bathroom Door, Pre-finished, Pre-hung, Privacy Lock
Partition Walls	As in Figure 1.

Table 2 Requirements for Roof, Insulation, Plumbing, and Electrical	
Roof	
Truss Type	Standard Code
Pitch/Design	3/12 roof pitch
Decking	5/8-inch min.
Ceiling Material	½-inch Gypsum, Seaspray finish
Standard Tie Downs	As required
Roof Covering	EPDM
Shingles	25-year fungus resistant, on 30# felt
Gutter\downspouts	5-inch aluminum rain gutter with a minimum of two aluminum downspouts on each 60-foot side. All discharges from gutters will be plumb to stormwater drain.
Insulation	
Floor	R-11
Walls	R-11
Ceilings	R-19
Plumbing	
Dishwasher	Residential grade w/water heating feature
Water Heater	20-gal Qty: 1 with Pan
Commode	Handicap Qty: 1
Shower	Handicap Fiberglass Qty: 1
Sink	Wall mount Qty: 1 Stainless steel 23 inches x 22 inches Qty: 1
Supply Piping	CPVC (stubbed out only)
Waste Piping	PVC (stubbed out only)
Electrical	
Transformer	120/240 Volt, Single-Phase, 30 kVA, indoors
Panelboard	120/240 Volt, Three-Wire, Single-Phase, w/125 A main breaker
Raceway	Copper Romex
Fluorescent Lights	Five surface-mounted 2- to 4-foot tubes with diffusers
Exit And Emergency Lights	One w/ battery backup
Exterior Lights	One w/ photocell @ each egress
Junction – Boxes (Phone or Data Cable)	Three stubbed out through office floor and each office exterior wall (non-wired)
Interior Receptacles	120V 15A receptacles @ 6-foot maximum spacing around office room
	120V 15A GFCI protected receptacles above counter @ 2-foot maximum in kitchen/lab
	120V 15A GFCI-protected receptacle @ restroom sink location
Exterior Receptacles	Two 120-V GFCI-protected receptacles with polycarbonate (in-use) covers (Owner-selected locations).

Table 3 Requirements for HVAC, Exterior, Cabinets, and Sink/Fixture	
HVAC	
Air Conditioning	One wall-hung heat pump unit (size as required to meet energy codes)
Thermostat	One factory standard
Supply Duct	Fiberglass supply duct w/ ceiling grills
Return Duct	At wall-hung unit w/ replaceable filter element
Exhaust Fan	One 110-CFM fan/light combo
Exterior	
Siding	0.019 aluminum
Mansard	18-inch false mansard-0.019 aluminum
Trim	0.019 aluminum
Windows	Vinyl or aluminum frames, clear glass, insect screens-w/ mini blinds
Doors	One 36-inch x 80-inch Steel door with windows and frame w/10-foot x 10-foot view block and closer
Base and Wall Cabinets – Residential Grade (Painted)	
Wood Base Cabinets	w/ stainless steel hardware
Wood Wall Hung Cabinets	w/ stainless steel hardware
Countertop	Plastic laminate
Sink/Fixtures	
Double Sink	Deep, stainless steel, heavy gauge
Faucet	Stainless steel as manufactured by Delta

END OF SECTION

SECTION 13150
PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.01 SCOPE

A. This Section covers programmable logic controllers of remote terminal units (RTUs/PLCs), including associated input/output hardware to control process equipment and serve as the interface to field devices. The Contractor through the use of a qualified PICS Supplier shall furnish, install, modify, configure and commission the Process Instrumentation and Control System (PICS).

1. Control System: The Instrumentation and Control System section, shall apply to all equipment furnished or modified under this Section. Additional PLC software requirements are indicated in Section 13030, Software Control Block Descriptions.

2. PICS Supplier shall be responsible for supplying the RTUs/PLCs in the following panels:

a. PLC-A.
b. PLC-B.

1.02 GENERAL

A. Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by the Engineer.

1. General Equipment Stipulations: The General Equipment Stipulations shall apply to all equipment and materials furnished under this Section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.
2. Drawings: Supplementing this Section, the drawings indicate the number and sizes of RTUs/ PLCs, locations of RTUs/ PLCs, and provide diagrams and schematics regarding connection and interaction with other equipment. All hardware, including power supplies, special cables, and other appurtenant equipment, shall be provided to meet the functional requirements described herein and indicated on the drawings.

3. I/O List: An input/output (I/O) field device signal listing is included as an appendix attached to this Section.

1.03 SUBMITTALS

A. Submittals shall be as specified in the Instrumentation and Control System section.

1.04 DELIVERY, STORAGE, AND SHIPPING

A. Delivery, storage, and shipping shall be as specified in the Instrumentation and Control System Section.

1.05 SPARE PARTS

A. Spare parts shall be furnished as follows:

Spare Part	Quantity
Processor modules	10%, Minimum 1 of each type used
Power supply modules	10%, Minimum 1 of each type used
I/O modules	10%, Minimum 1 of each type used
Communications modules	10%, Minimum 1 of each type used
SPD units	20%, Minimum 3 of each type used

1.06 I/O POINT LIST DESCRIPTION

A. The I/O point list contains the information necessary to configure the RTU/PLC I/O interface hardware and to indicate range conversion or signal functions.

B. "P&ID TAG" is an alphanumeric character string. For example, the point HCP-FI-813-0123-A, the following apply:

1. The three-letter character string (HCP) identifies the Control Panel. Refer to SCADA network diagram for control panel identifiers.
2. The next alpha character is the functional identifier and follows ANSI/ISA-S5.1. In the example, the "F" represents flow.
3. The next alpha character (I) is the function identifier. In the example, the "I" represents an analog input.
4. The three-digit number (813) identifies the P&ID number.
5. The four-digit number (0123) identifies the loop or field device.
6. The final character (A) is used, as required, as a suffix to differentiate multiple points in the same loop.

C. “DESCRIPTION” is an alphanumeric character string that describes the I/O point. Points described as “SPARE” denote pre-wired I/O.

D. “SIGNAL TYPE” is one of the following:

1. AI designates an analog input.
2. DI designates a discrete input.
3. AO designates an analog output.
4. DO designates a momentary, maintained or latched discrete output.
5. DNT designates DeviceNet communication.
6. I/P designates Ethernet Industrial protocol

E. “RANGE/ SETPOINT” is a numeric value denoting the minimum and maximum signal value of the controlled variable. Information in this column is provided only for analog points. For all instrumentation, RANGE information is provided.

F. “UNITS/ N.C. Status” denotes the unit type as it applies to the RANGE. Wherever applicable N.C Status defines the normal control status.

G. “POWER FROM” indicates where power for the instrument/device producing the signal originates from.

H. “SIGNAL FROM DEVICE” indicates the instrument/device which produces the signal.

I. “SIGNAL FROM TB” is the terminal block number where the signal wire is terminated. Information in this column shall be provided by Contractor.

J. “SIGNAL FROM TERMINAL #” is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.

K. “SIGNAL FROM TERMINAL #” is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.

L. “SIGNAL TO DEVICE” indicates the instrument/device which receives the signal.

M. “SIGNAL TO TB.” is the terminal block number where the signal wire is terminated. Information in this column shall be provided by Contractor.

N. “SIGNAL TO TERMINAL #” is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.

O. "SIGNAL TO TERMINAL #" is the terminal number where the signal wire is terminated. Information in this column shall be provided by Contractor.

P. "RTU/PLC ADDRESS" indicates the device/channel number of the point. Information in this column shall be provided by Contractor.

Q. "Comments/ Notes" indicates comments or notes if there are any.

1.07 WARRANTY

A. General Warranty: The special warranties specified in this Article shall not deprive Owner of other rights or remedies Owner may otherwise have under the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under the Contract Documents.

B. Special Warranties

1. Furnish manufacturer's written 2-year warranty from date of substantial completion against failure or faulty workmanship of the RTU/PLC. Services during the warranty period shall include repair or replacement, and all costs related to visits to site, as necessary to remedy defects.

PART 2 PRODUCTS

2.01 PROCESS AUTOMATION CONTROLLER (PAC) – RTU/PLC

A. Hardware

1. Major hardware components of the PAC portion of the control system shall include:

a. Power Supply and Chassis.
b. Central Processing Unit (CPU).
c. Input/Output Modules.
d. Programming Software.
e. Communications Equipment.
f. Local Operator Interface.
g. Distributed Remote I/O.

2. General:

a. The PACs shall provide a control layer between the PC based operator workstations and field mounted transducers, switches, controllers, and process actuators. The PAC shall be an intelligent,

programmable, microprocessor-based device that can collect and store data, process and time stamp alarms, provide analog and discrete process control functions and communicate to PC based workstations. The PACs shall support 10/100 Mbps Ethernet 802.3/u compliant data highways and RS 232/485 serial communication communicate between the PACs, third party devices and PC workstations.

b. All components of the PAC system shall be manufactured to normally recognized industry standards for temperature, electrical interference, vibration, etc. and regularly sold for industrial installations.

c. The PAC system shall be of modular design with a plug-in central processing unit, power supply and input/output modules. All components shall be marketed and supported by the one manufacturer.

d. Where main power is available, a single external 120/240 VAC to 12/24 VDC main power supply shall have the capability of supplying power to the internal power supply/sequencer, CPU and local input/output modules. The system power supplies shall be fused for overload protection.

e. Where main power is unavailable, the PAC shall be capable of being powered by a solar array, regulator and battery bank in lieu of a 120/240 VAC to 24 VDC main power supply. The RTU/PLC shall be designed for low power consumption in order to minimize the size of the backup batteries and solar equipment. The CPU, power supply and backplane alone shall draw no more than 1.5W.

f. The PAC shall be an intelligent, programmable controller capable of stand-alone control operation in the event of failure of the communication link to the operator workstations. During a communication failure, it shall continue to store time-stamped alarm and historical data in non-volatile memory for access upon restoration of the communication network.

g. All products shall be designed, manufactured, and tested in accordance with recognized industrial standards. The RTU/PLC shall adhere to the following environmental specifications:

(1) UL, CUL, CSA or FM, Class 1, Div.2, Groups A – D approval for operation in hazardous locations.

(2) Vibration: 1.0G, 10-150 \Hz, 0.5 g over 150-1000 Hz. The system is to be operational during and after testing.
(3) Temperature. All RTU/PLC hardware shall operate at an ambient temperature of -40 to 70 degrees C (-40 to +158 degrees F), with an ambient temperature rating for storage of - 40 to + 85 degrees C (- 40 to + 185 degrees F).
(4) Relative Humidity. The Programmable Controller hardware shall function continuously in the relative humidity range of 5% to 95% non-condensing.
(5) Noise Immunity. The Programmable Controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant as governed by the following regulations: EEE 472, IEC 801, and ANSI/IEEE C-37.90A-1978.

h. The supplier shall provide operating instruction manuals with adequate information pertaining to the following:

(1) System specifications.
(2) Electrical power requirements.
(3) Grounding procedures.
(4) Assembly, and installation and wiring procedures.
(5) Power up and shut down procedures.
(6) Diagnostic and troubleshooting procedures.
(7) Programming procedures.
(8) Warranty and repair procedures.
(9) Recommended spare parts list.

i. The supplier shall have the capability to provide product application assistance by trained and experienced engineers to assist the Owner with program and system development through telephone consultation and on-site check-out, debug, and start-up assistance.

j. The supplier shall have the capability to conduct on-site training programs at a location provided by the customer.

k. The supplier shall supply Internet based technical support and FAQs on their web site.

l. Modules are defined herein as devices that plug into a chassis and are keyed to allow installation in only one direction. The PAC program must continue to run even without physical I/O modules installed in the chassis.

m. All system modules, main and expansion chassis shall be designed to provide for free airflow convection cooling. No internal fans or other means of cooling, except heat sinks, shall be permitted.

n. The manufacturer shall have a fully operational quality assurance and quality control program in place and shall comply with ISO9001:2000 standards for "Quality Systems-Model for Quality Assurance in design/Development, Production, Installation, and Servicing".

o. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings, each of which indicates the manufacturers catalog number and a product manufacturing date code.

p. The PACs shall be one of the following:

(1) Rockwell Automation.

3. Power Supply and Chassis:

a. Chassis:

(1) The I/O chassis shall provide for directly mounting the CPU, power supplies, communication modules, and the I/O modules. Chassis shall be available in sizes to house two, four, eight, and up to fourteen I/O local modules. Both panel and DIN-rail mounting shall be available as standard offering.

b. Internal Power Supply:

(1) The internal power supply/sequencer (DC to DC converter) shall operate on 11 to 30V dc to power the CPU, communication cards, and I/O modules.
(2) Power supply health and voltage output levels shall be monitored by the CPU.
(3) At the time of power-up, the power supply/sequencer shall inhibit operation of the processor and I/O modules until the DC voltages are within specifications.
(4) The internal power supply shall not consume an available I/O slot.

(5) The measurement of the voltage supplied to the power supply module shall be available as a floating-point value to the internal software for monitoring and/or trending purposes. The use of an external converter and an analog input is not acceptable.

4. Central Processing Unit (CPU):

a. General:

(1) The CPU shall be a plug-in module providing program execution, system timing, local and remote I/O access, alarming, data storage, and communication handling. The CPU shall be a 32-bit microprocessor. It shall execute application programs conforming to the IEC 61131-3 standard and use a real-time multitasking operating system.

(2) The CPU shall be a single printed circuit board utilizing surface mount technology. The CPU shall be available with options for processor speed and memory organization. In addition, the CPU shall be available with or without Ethernet to meet suitability for low power installations.

(3) The CPU shall be supplied with a battery-backed time of day clock and calendar.

(4) A three-position, mechanical keylock switch, with removable key, shall be provided. RUN mode will prevent any on-line modification to the application control program. REMOTE mode will allow on-line modification via the network connection only. LOCAL mode will allow modification via network and via a locally connected PC.

(5) The CPU family shall allow for user program transportability from one CPU model to another.

(6) The CPU shall not consume an available I/O slot.

b. Capacity:

(1) The CPU shall be capable of controlling both local I/O in the chassis and remote I/O in one or more distributed expansion chassis'

(2) The processing of a typical logic program consisting of a mix of analog and digital commands shall not exceed 2 milliseconds for 1024 instructions. I/O devices located in the same backplane as the CPU should be scanned in less than 0.5 milliseconds.

c. Diagnostics:

(1) The CPU shall perform on-line diagnostics that monitor the internal operation of the PAC. If a failure is detected, the CPU shall initiate error messages and initiate a system shutdown if a fatal failure occurs. The following at a minimum shall be monitored:

(a) Memory Failure shall cause a Watchdog to occur.
(b) Memory battery low shall generate an operator message.
(c) CPU general fault shall suspend processor operation.
(d) Communications port failure shall generate an operator message.
(e) Scan time over run shall generate an operator message.
(f) I/O failure shall generate an operator message.
(g) Analog I/O over/under range shall generate an operator message.
(h) The system shall be completely tested upon power-up and any failures shall be posted to a local display.

(2) All on-line diagnostic information shall be stored and made available to the communication system as alarm conditions with the date and time of occurrence of the fault.

(3) All on-line diagnostic information shall be accessible to the PAC application program.

(4) The CPU shall have LED indicators to show status such as PAC GOOD, PROGRAM IDLE TIME, and Power OK/FAIL. If any of the above conditions fault, the CPU shall visually display an internal PAC diagnostic fail alarm and present a diagnostic display on the CPU LEDs.

d. Programming Environment:

(1) The CPU shall be capable of being programmed by an external MS Windows PC via a serial communication port on the PAC and remotely via the Ethernet communication interface.

(2) The programming PC shall have access to the application program, the system configuration, all registers, I/O, system fault status, I/O override, and system diagnostics.

(3) Application programs and modification may be downloaded into the CPU flash memory, while the CPU is running the current application program from RAM memory with minimal impact on the scan time. The new downloaded program can then be quickly activated to RAM for execution.

(4) The CPU shall support all five-industry standard IEC 61131-3 programming languages. As a minimum, Function Block Diagram, Ladder Diagram, Structured Text, Instruction List, and Sequential Function Chart (SFC) programming shall be provided.

(5) The CPU shall be able to be programmed and monitored over the Ethernet and serial communication networks ports via a laptop (PC).

(6) The programming software shall support the use of Ladder Diagram and Function Block Diagram in the same program and the same worksheet.

(7) The software shall make use of precompiled firmware libraries as well as user defined function blocks and user defined function libraries. User defined libraries shall be easily ported from one project to another without the use of "Cut and Paste".

e. Memory:

(1) The CPU shall contain the several memory types suitable to the data being stored.

(a) 16 MB non-volatile Flash memory shall be used to store the application program code, historical data archive and audit files. In addition, any other files such as as-built drawings, maintenance logs, instructions and graphic files may be transferred to the flash memory via FTP (File Transfer Protocol). In addition, the entire program source including all graphics shall be stored in a single zipped file in the flash memory. It shall be possible to upload this entire program into the original program source for editing.

(b) Retained values, unreported alarms and data shall be stored in 1 MB battery backed Static RAM. The

RAM memory battery backup system shall be capable of retaining all memory for a minimum of 3 months under load.

(c) 4 MB of high-speed dynamic RAM shall be used for the actual program execution and temporary data values. In low power applications without Dynamic RAM, 2 MB Static RAM shall be used for program execution.

(2) Internal detection of low memory backup battery condition shall be indicated on a Diagnostic LED for local indication and also a low battery alarm variable shall be provided to alert an operator at the PC workstations.

(3) The program memory shall be sized as required to implement the functions specified plus a minimum of 10% spare. Scratch pad or "housekeeping" programs shall not be counted in memory size rating.

(4) The PAC CPU memory addresses shall be automatically configured when configuring the I/O points using 'Tag Names'. Tag names of at least 32 characters shall be allowed. The Engineer shall not be required to assign memory addresses to the individual points.

f. Archiving:

(1) The PAC shall have the ability to perform automated archiving of historical data to nonvolatile Flash RAM or battery backed RAM.

(2) Each row of archive data will be time stamped and contain a sequence number.

(3) Each column of data shall be able to be independently configured to use one of the following functions:

(a) Weighted average.
(b) Time Based average.
(c) Average of the square root of the archived point.
(d) Square of the average of the square root of the archived point.
(e) Snapshot.
(f) Minimum value observed during the period.

(g) Maximum value observed during the period.
(h) Capture a totalized value and reset it to 0.
(i) Total of the archived point over the period.

g. Event Audit Logging:

(1) The PAC shall be able to monitor both analog and digital values and log any change to these values to an Alarm and Event Audit trail for auditing purposes. Each record in the log shall contain:

(a) The date and time that the change was made.
(b) The variable or tag name of the changed data point.
(c) The old value.
(d) The new value.

(2) The PAC shall be able to log alarm occurrences to the Audit trail log. Each record in the log shall contain:

(a) The time and date of the alarm.
(b) The variable or tag name of the changed data point.
(c) The priority of the alarm (Critical, Non-Critical, Guide, Event).
(d) The type of alarm (High, Low, High High, Low Low, Return to Normal).
(e) The alarm limit.
(f) The value that triggered the alarm.

(3) A minimum of 500 auditable changes and 500 alarms shall be able to be logged.

5. Local Input/Output Modules (I/O):

a. General:

(1) The I/O count and type shall be determined, as that required to implement the functions specified plus an allowance for active spares as noted below.

(2) Each I/O drop or I/O location shall include 20% active input points (both DI and AI) and 20% active outputs points (both DO and AO) for future use. The spares shall be the same types of I/O modules supplied. Spare output

points that require the use of an external relay shall be supplied with the external relay.

(3) The I/O modules shall be available with both local and remote terminations. Local terminations allow field wiring directly to the I/O module with up to 14-gauge wire. Remote, DIN rail mounted, termination modules connect to I/O module cards in the PAC chassis via pre-assembled mass terminated cables.

(4) Field wiring terminal blocks shall be pull-apart type, if mounted on the I/O modules to allow I/O module replacement without disconnection of the field wiring. All field wiring terminal blocks shall be 300V minimum NEMA rated, and accommodate no less than #14 gauge wire.

(5) Surge protection on all modules shall meet C37.90-1978 and IEC 801-5 standards

(6) I/O module usage shall comply with the following table unless noted otherwise:

I/O Type	Channel/Module	Module Type
Analog input	6	1-5 Vdc or 4-20mA (externally sourced
Analog input	8	4-20mA (internally sourced
Analog output	4	4-20mA (externally sourced)
Discrete input	16	Internally sourced dry contact
Discrete input	8	120/240 VAC and 24 VDC (externally sourced)
Discrete output	8	120/240 VAC and 24 VDC open drain (externally sourced)
Counter input	4	24 VDC (externally sourced) (0-10 KHz)
Counter input	4	Internally sourced (0-10 KHz)
Thermocouple	6	B, R, S, J, E, K, T, C, N, +/- 10 mV
RTD	4	2, 3 or 4 wire 100 ohm Platinum
Mixed DI/DO	12 DI, 4DO	
Mixed AI/AO	6 AI, 2 AO	
Mixed I/O	6 DIO, 4 AI, 1 AO, 2 HSC	

b. Discrete I/O:

(1) Open source outputs shall be solid state MOSFET with an operating voltage range of 10 – 31 Vdc with a capability of sinking up to 500 mA.
(2) Remote terminated Relay type outputs shall be Form-C type (both NO and NC contact) and shall be rated for 5.0 amps continuous. These type outputs shall be used on all MCC circuits or other inductive loads. Local direct wire to I/O module outputs shall be solid state relay rated 6A at 120/240 VAC.
(3) Each discrete input and output shall have an LED or other visible indication of on/off status.
(4) Discrete input and output modules shall be available with optional 500 V to the chassis and 1500 V optical isolation to field devices.

c. Analog I/O:

(1) All of the analog inputs shall have at least 14-bit resolution and all analog outputs shall have at least 12-bit resolution. Analog input and output system accuracy shall be within .1% of full scale at 25° C and .3% of full scale from –40° to +70°
(2) Analog input and output modules shall be available with optional 500 V isolation to chassis.

B. Software

1. Operating System:

a. The PAC shall use a real-time, pre-emptive multitasking operating system allowing program execution to be scheduled and prioritized. The application program shall run from complied code for fast execution.
b. The operating system shall reside in the PAC itself. It is not acceptable to transfer data to a PC containing the operating system.

2. PAC Programming Software:

a. The supplier shall provide all PAC configuration software packages complete with documentation, disks, licenses, and copy protection devices to allow application development.

b. The software package shall allow off-line program development and on-line editing, annotation, monitoring, debugging, uploading, and downloading of programs to the PACs via RS-232-C, RS-485 and Ethernet data highway.

c. All required hardware (including cables, cable adapters, etc.) to allow the PAC's connection to a Standard RS-232-C, RS-485 and Ethernet data highway personal computer port shall be furnished.

d. The software package shall include a software license agreement allowing the Owner the right to utilize the software as required for any current or future modification, documentation, or development of the PAC's furnished for this project.

e. The software shall be capable of the following IEC 61131-3 functions:

(1) Function Block Diagram.
(2) Sequential Function Chart.
(3) Instruction List.
(4) Structured Text.
(5) Ladder Diagram.

f. The system shall have the capability to create and reuse User Defined Function Blocks containing one or more functions or function blocks. These User Defined Function Blocks shall be stored in a User Library that is transportable between application programs. Each User Defined Function Block shall have reassignable inputs and outputs so each instance of the function block can have different variables attached to the terminals.

g. The system software shall be Microsoft Windows-based and run in a Windows 10 environment and include a 32-bit simulator capable of executing the application program in the PC to allow the Engineer to test and debug the program prior to downloading to the PAC.

h. The software shall also include a live I/O simulator which will allow the developer to test programs without the necessity of being connected to a PAC.

i. The system shall provide extensive on-line program debugging tools to allow analysis and troubleshooting of the application program. Live dynamic variable values shall be displayed in the

application program worksheets and languages in which they were developed. The debugging tools shall include as a minimum the following capabilities:

(1) Variables Cross Reference containing all variables, Function Blocks, Actions, Transitions and connections used in the program.
(2) A graphical Logic Analyzer to record and trend variable values over a certain time interval.
(3) A Watch Window to display variable values of interest, from different worksheets, in a single window.
(4) Breakpoint, Step and Single Cycle program execution to step and trace execution.
(5) Built-in Data Line Monitor for serial communication message monitoring and debugging.

j. The software shall include a security feature to prevent unauthorized personnel from modifying and downloading the program to a PAC. The security shall consist of an ID and Password sign-on to access on-line functions.

k. The username and password shall be stored on the PAC itself and not in the application development software. The security features can only be adjusted by an individual who has access to an administrative level ID and password for the PAC.

l. The software shall have extensive on-line Windows-based help screens.

m. Annotation shall be possible from any Microsoft Windows application. Full text import and export of reference data shall also be possible.

n. The software shall support local and remote downloading of the IEC 61131-3 application and control program selectively to flash and RAM memory. In addition, the entire application source may be downloaded and stored in Flash memory for future upload to the IEC 61131-3 programming software.

3. Instruction Set:

a. The IEC 61131-3 instruction set, manufacturer libraries and functional extensions shall be pre-programmed Firmware and installed in the RTU/PLC by the manufacturer.

(1) Firmware upgrades will be made available to authorized users on the manufacturer's web site. Firmware upgrades may be downloaded to the RTU/PLC flash memory via a locally connected PC or remotely via any wired or wireless serial or Ethernet port utilizing the manufacturer's protocol. Remote Firmware downloading shall not interrupt RTU/PLC measurement or control operations or normal data communication during the download process. A brief interruption upon completion will be acceptable to allow activation of the new Firmware.

(2) A communication failure during the download process must not allow corrupt Firmware to execute in the RTU/PLC. Incomplete Firmware downloads due to a communication failure will be completed when proper communication is reestablished.

b. The CPU shall be capable of performing high-level instructions including data word functions such as:

(1) Four-Function Math: The CPU shall be capable of performing addition, subtraction, multiplication, and division on integer and floating-point numbers.

(2) Compare Function: The CPU shall perform the compare function that compares two integers for less than, equal to, greater than, and not equal to. The programmed function shall energize when true and de-energize when false.

(3) Move Function: The CPU shall be able to move a bit, byte, word, double word, integer, and floating-point value from one memory location to another memory location.

c. The PAC CPU shall perform all the functions of the conventional three-mode (PID) analog controller. The CPU shall be able to process up to 64 PID loops. The number of PID loops shall be limited only by the installed physical hardware and shall not be constrained by software limits. Each PID loop shall incorporate an anti-windup algorithm.

d. The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory.

e. The PAC shall be capable of executing nested conditional logic including IF, THEN and ELSE, which will allow the programmer to control program execution.

f. It shall be a function of the CPU to convert between all data types. For example, the CPU shall allow conversion between Integer, Real, String, BCD and Boolean.

g. The system shall have the capability to enter comments in any free workspace area of Ladder Diagram, Function Block and Sequential Function Chart diagrams.

h. The system shall have a means to program a fault recovery routine. When a major system fault occurs in the system, the fault recovery routine shall be executed, and the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution resumes. If the fault still exists, the system will shut down. A user shall have the option to either resume operation or to shut down upon fault detection.

i. Multiple cyclic interrupt routines having assignable interrupt priority shall be programmable such that the routine shall be executed regularly. The interval at which the routine is executed shall be user-specified in the range of 1 to 65,535 milliseconds.

j. Supported trigonometric instructions must include Sine, Cosine, Tangent, Inverse Sine, Inverse Cosine, and Inverse Tangent. These instructions must fully support floating-point math and be accessible in ladder and other programming languages.

k. Additional floating-point instructions must support Natural Log and Exponential.

l. It shall be possible to complete complex, combined calculations in a single instructions or equations of the format ((A+((B-C)*D))/E).

m. Variable operation functions shall include Average, Square Root, Integration, Differentiation, Totalize, and lead/lag.

n. Variable selection functions shall include a Comparator to select an output based on comparison of two analog inputs and Multiplexor to select from a group of inputs.

C. Communications

1. Communication Ports and Remote I/O Communications:

a. The CPU shall support up to three built-in serial communication ports for programming, operator interface peer-to-peer communications and remote I/O operations. The serial ports shall support data rates up to 115.2 K baud.
b. The CPU shall have two optional 10/100 MHz Ethernet port for peer-to-peer, operator interface and remote I/O. The connections shall be standard 10/100Base-T, RJ45 connections. The Ethernet ports shall provide independent Ethernet networks with routing capability.
c. A dedicated port shall be available to connect to the manufacturers Local Operator Display. This display shall not require the use any of the available programming or network serial communication ports.
d. Serial ports expansion shall be available providing at least two additional built-in RS 232 and two additional RS 485 ports. In addition to the two serial ports, communication expansion shall allow one built-in 900 MHz spread spectrum radio and one built-in V.90 dial-line modem.
e. A 'Virtual Port' software function shall be included in the standard instruction set to redirect serial messages to an IP Ethernet port allowing serial port expansion through the use of commonly available Terminal Servers. It shall be possible to mix protocols through the virtual port to multiple serial devices connected to Terminal Servers.

2. Protocols:

a. In addition to the PAC manufacturers own serial protocol, the PAC shall also support the following serial protocols:

(1) Serial RTU and ASCII Modbus.
(2) Ethernet I/P.
(3) DNP3.
(4) HART protocol (via an external, field loop, HART transceiver).

(5) DF1.
(6) Generic ASCII protocols.

b. In addition to the PAC manufacturers own IP protocol, the PAC shall also support the following IP protocols over TCP/IP or UDP/IP:

(1) Open Modbus (Modbus over IP).
(2) DNP3.
(3) CIP.
(4) FTP.
(5) SMTP.

c. The PAC shall support the use of serial ports as IP ports by employing the Point to Point Protocol (PPP). Access via PPP shall have the following security options:

(1) None.
(2) Plain Text Authorization (PAP).
(3) Encrypted Challenge Authorization (CHAP).

d. The Modbus protocol shall be designed to communicate with as many other Modbus capable devices as possible. The following configuration parameters shall be available:

(1) Gould or Enron variants.

(2) Select 0 based or 1 based counting for address offset.

(3) High bit first or low bit first.

(4) High byte first or low byte first.

(5) High word first or low word first.

(6) The use of 8-, 16-, or 32-bit registers for Integer values.

(7) The use of two 16-bit or one 32-bit registers for IEEE floating point values.

(8) The ability to adjust the register count and address range in the Modbus message for devices storing 32-bit values as:

(a) One 32-bit register taking up one address space and accessed by a call for one register.
(b) Two 16-bit registers taking up two address spaces and accessed by a call for two registers.
(c) Two 16-bit registers taking up one address space and accessed by a call for two registers.

(9) The following Modbus commands shall be able to be used by a Modbus Master Port or responded to by a Modbus Slave Port:

(a) 1 – Read Coil Status.
(b) 2 – Read Input Status.
(c) 3 – Read Holding Registers.
(d) 4 – Read Input Registers.
(e) 5 – Force Single Coil.
(f) 6 – Preset Single Register.
(g) 7 – Read Exception Status.
(h) 15 – Force Multiple Coils.
(i) 16 – Preset Multiple Registers.

e. Each communications port can be configured, independently, for Modbus. That is, different ports could utilize completely different configurations, including different variants of Modbus and different register memory maps.

f. The PAC protocol shall support program file downloading, on-line program editing and debug, historical file transfer, alarm message transmission and network time-syncing.

g. The PAC protocol shall support a Report-By-Exception (RBE) polling mechanism to minimize communication overhead in low bandwidth networks. Data values will only be transmitted if they have changed beyond the specified deadband.

h. The supplier shall provide web-based PC software for PAC configuration and data access. It shall rely on an open architecture, industry standard, .html format and be compatible with Microsoft

Internet Explorer. The software shall provide access to the data via Internet, Intranet, dedicated networks and direct local connections.

(1) The software shall include a set of ActiveX Controls for reading and writing real-time and historical data, trending, recipe editing and custom display generation.
(2) The custom as well as pre-configured web interface may be stored on a PC or downloaded to the PAC flash memory. It may then uploaded from the flash memory and run on the PC.

i. The supplier shall provide an OPC Server compliant with OPC Data Access specification 1.0a and 2.0 and the OPC Alarm and Event specifications.

(1) The OPC server shall provide a background polling mechanism capable of refreshing the database at a slower scheduled rate than the primary polling rate for current active display and trend data.
(2) The OPC server shall provide tag browsing by compatible client applications.
(3) The OPC server database shall be created automatically by reading the PAC tag file. Retyping of the PAC tags to generate the OPC server database is not acceptable.

D. Local Operator Interface

1. Keypad/Display:

a. Configuration and Firmware Stored in Non-volatile FLASH Memory.
b. 10.4-inch TFT Display.
c. Resistive Analog Touchscreen.
d. Dedicated MENU Key and 7 Soft-Keys.
e. Integrated Protocol Converter.
f. Up to 5 RS-232/422/485 Serial Ports.
g. 10-Base-T/100-Base-TX Ethernet Port.
h. Outdoor models available (G310S2).
i. Remote Web Access and Control Facility.
j. USB Port for Configuration Download.
k. Compact Flash Socket.
l. NEMA 4X/IP66 Front Panel.
m. 24V DC Operation.

2. Manufacturer:

a. Rockwell PanelView.

E. I/O Expansion

1. I/O Expansion Rack:

a. I/O shall be expandable beyond the base PAC chassis by interfacing to one or more I/O Expansion chassis'. The I/O expansion chassis' shall be the same as the main PAC chassis and support all of the same I/O modules. The application control program shall run in the main PAC CPU.
b. This main PAC CPU will interface to the I/O Expansion chassis communication module via one of the available Ethernet ports. The I/O Expansion communication processor shall not require programming or variable address mapping of I/O.

F. RTU/PLC I/O Surge Protection Devices (SPD)

1. Analog Signals. All analog require SPDs at both ends of the circuit. The SPD shall:

a. The SPD shall consist of a multistage hybrid unit that does not use metal oxide varistors (MOVs), not interfere with the normal operation of the device, and have a trip level less than the surge withstand level of the instrument.
b. The SPD shall be designed to withstand a 10 kA test current of a (8/20) us waveform per IEEE C62.41.-2002, category C Area.
c. SPDs used in Division 1 hazardous areas will conform to EN 020/DIN EN 50 020/VDE 0170/0171 part 7: 1996-04. SPDs in hazardous areas shall provide at least 500V isolation between intrinsic safety ground and earth ground.
d. The SPD shall have a series resistance less than 10 ohms and a maximum operating load of 250 mA.
e. The SPD shall have an operating temperature range of -40ºC to +80ºC.
f. The SPD shall provide line-to-line and line-to-ground protection.
g. The SPD shall be DIN rail mountable or pipe mountable depending on the application.
h. No more than two analog signals per SPD will be allowed.
i. The SPD shall be Phoenix Contact PlugTrab PT 2x2 series or MTL SD-32 series for DIN rail mounting, and Phoenix Contact

PipeTrab S-PT 1 series, or MTL TP-P pipe series for conduit installation at the instrument.

2. Digital Signals: All RTU/PLC digital input and output signals shall be protected with a Surge Protection Device (SPD) in the RTU/PLC enclosure. Relay isolated outputs do not require a SPD, but do require surge suppression across the relay coil.

    a. The SPD shall consist of a multistage hybrid unit that does not use metal oxide varistors (MOVs), not interfere with the normal operation of the device, and have a trip level less than the surge withstand level of the instrument.
    b. The SPD shall be designed to withstand a 10 kA test current of a (8/20) us waveform per IEEE C62.41.-2002, category C Area.
    c. SPDs used in Division 1 hazardous areas will conform to EN 020/DIN EN 50 020/VDE 0170/0171 part 7: 1996-04. SPDs in hazardous areas shall provide at least 500V isolation between intrinsic safety ground and earth ground.
    d. The SPD shall have a series resistance less than 10 ohms and a maximum operating load of 250 mA.
    e. The SPD shall have an operating temperature range of -40ºC to +80ºC.
    f. The SPD shall provide line-to-line and line-to-ground protection.
    g. The SPD shall be DIN rail mountable.
    h. No more than two signals per SPD will be allowed.
    i. The SPD shall be Phoenix Contact PlugTrab PT 2x2 series or MTL SD-32 series selected for the application and voltage range

3. Communications Signals: All copper serial communications links (RS-232, RS-485) shall be protected at both ends of the circuit, or as shown on the system block diagram.

    a. The SPD shall consist of a multistage hybrid unit that does not use metal oxide varistors (MOVs), not interfere with the normal operation of the device, and have a trip level less than the surge withstand level of the instrument.

    b. SPDs for shall be UL497B listed.

    c. SPDs used in Division 1 hazardous areas will conform to EN 020/DIN EN 50 020/VDE 0170/0171 part 7: 1996-04. SPDs in hazardous areas shall provide at least 500V isolation between intrinsic safety ground and earth ground.

d. SPDs for data communication shall have a minimum cutoff frequency (3 dB) of 100MHz for 50 ohm systems.

e. The SPD shall have a series resistance less than 2.2 ohms and a maximum operating load of 250 mA.

f. The SPD shall have an operating temperature range of -40ºC to +80ºC.

g. The SPD shall provide line-to-line and line-to-ground protection.

h. The SPD shall have a peak clamping voltage of +/- 25 V dc.

i. The SPD shall be DIN rail mountable.

j. The SPD shall be designed to withstand a 10 kA test current of a (8/20) us waveform per IEEE C62.41.-2002, category C Area.

(1) The SPD shall be Phoenix Contact Data-PlugTrab PT PT5-HF Series, or MTL SD-32 series selected for the application and voltage range.

(2) RTU/PLC Analog I/O Signal Isolation. All RTU/PLC analog signals will be provided with 3-way signal isolating amplifiers. Signal isolation power supplies shall be separate from field digital input power supplies.

PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. RTUs/PLCs installation requirements are specified in the Division 13, Special Construction, sections except as described herein.

B. Field check, testing, and training shall be as specified in the Instrumentation and Control System section.

3.02 CONFIGURATION

A. RTU/PLC Programming and Configuration: Configuration services are as specified below and as specified in Section 13030, Software Control Block Descriptions.

B. Programming Responsibilities: System Supplier will have all RTU/PLC and HMI programming responsibilities for the project as tabulated below. The System

Supplier shall provide all programming services or any Test software required for acceptance testing.

	PROCESSOR ID	MODEL	RESPONSIBILITY
1.	PLC-A	ControlLogix	PICS Supplier
2.	PLC-B	ControlLogics	PICS Supplier

C. Communications Configuration: The communications devices shall be fully configured and installed by System Supplier. Communications shall be configured as shown on the drawings.

3.03 I/O CONFIGURATION

A. Implement the control system database fields in a consistent manner by using the following procedures:

1. Use abbreviations and acronyms already established in the Contract Documents. In particular, use the information in the I/O Point List.
2. Use only abbreviation or acronym for a word or group of words, respectively.
3. Use the same subject and word order within data fields.
4. Use the same term (phrase, word, or acronym) to denote the same meaning. Do not use multiple terms for a single meaning.
5. Use the point names, descriptions, logic state descriptions, ranges and units of measurement exactly the same wherever the point is referenced.
6. Show point names and descriptions for all point references on documentation.
7. Spell correctly.
8. Maintain lists of acronyms and abbreviations used.

3.04 I/O HARDWARE CONFIGURATION

A. Partition the I/O among cards within an I/O enclosure to provide control loop integrity.

1. Put all inputs of the same I/O type associated with a device (e.g., pump, blower, clarifier or other piece of equipment) on the same card.
2. Put all inputs of the same I/O type for devices arranged in process trains (e.g., a pump, its inlet valve and its outlet valve, or a pump and its associated macerator) on the same card or cards if more than one card is required to accommodate the points.
3. Put all outputs of the same I/O type associated with a device or group of devices in a process train on the same card or cards if more than one card is required to accommodate the points.

4. Where the preceding requirements specified in this paragraph would cause more than 20% spare points on a card, points for a device or process train may be split between two consecutive cards.
5. Make unused terminals resulting from partitioning the I/O into pre-wired spares. Provide pre-wired spare points with all cabling and termination internal to the DCU as done for other I/O points.

3.05 POINT DATA FIELDS

A. I/O point data fields may be subject to review and modification by the Engineer during the Shop Drawing review phase. Incorporate changes directed by the Engineer completely into the entire system, at no additional cost to Owner, subject to the following limitations:

B. Limit the total number of modifications to 20% of the total number of I/O points.

C. Each unique change will count as one modification. For example, modifying the description, range, and engineering unit on an analog input count as three modifications.

D. Analog input alarm limit definition will not be counted as a modification.

END OF SECTION

SECTION 13200
PROCESS CONTROL SYSTEM INPUT/OUTPUT LIST

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. This Section describes the system input/output (I/O) list, which follows this Section and requirements for configuring the control system database.

B. Related Sections

1. Section 13150, Programmable Logic Controllers.

C. Refer to the attachment at the end of this specification for the 13200A – PLC Input/Output List.

1.02 SUBMITTALS

A. For each I/O attribute listed in the I/O list that cannot be used exactly as listed, submit an explanation of the reason for the deviation and propose a method to modify the I/O list information. Do not proceed with any configuration until a method of resolving deviations is accepted by the Engineer.

1.03 I/O POINT LIST DESCRIPTION

A. The I/O point list contains the information necessary to configure the PLC or PLC I/O interface hardware and to indicate range conversion or signal functions.

B. “POINT NUMBER” is an alphanumeric character string. For example, the point MP-F0123I1, the following apply:

1. The first two characters (MP) refers to the specific plant area (MP = Main Pump, for example).
2. The third character is the functional identifier and follows ANSI/ISA-S5.1. In the example, the “F” represents flow.
3. The four-digit number (0123) identifies the loop or field device.
4. The next alpha character (I) is the function identifier. In the example, the “I” represents an analog input.
5. The final numeric character (1) is used, as required, as a suffix to differentiate multiple points in the same loop.

C. “DESCRIPTION” is an alphanumeric character string up to 40 positions in length. Points described as “SPARE” denote pre-wired I/O.

D. “SIGNAL TYPE” is one of the following:

1. AI designates an analog input.
2. DI designates a discrete input.
3. PI designates a pulse input.
4. AO designates an analog output.
5. DO designates a momentary, maintained or latched discrete output.

E. “DATA FIELD 1” and “DATA FIELD 2” describes the function or signal characteristics. These are further defined under each signal type.

F. “RELAY” is used only for discrete outputs to indicate the action of the contacts:

1. “MO” designates momentary action.
2. “MA” designates maintained action.

G. “ALARM” is used only for discrete inputs to distinguish between status inputs and alarm inputs.

H. “CROSS REFERENCE” is used to designate those I/O points that are transferred between the DCU and PLC via the digital communications link (PLC Gateway). Designation is made by listing "PLC" under the reference description.

1.04 SIGNAL TYPE DESCRIPTION

A. Analog Input

1. “DATA FIELD 1” is the electrical input signal range and units.
2. “DATA FIELD 2” is the process parameter range and engineering unit.

B. Discrete Input

1. “DATA FIELD 1” is the condition that exists when a field contact is closed.
2. “DATA FIELD 2” is the condition that exists when a field contact is open.

C. Pulse Input

1. “DATA FIELD 1” is the pulse frequency range.
2. “DATA FIELD 2” is the process parameter range and engineering unit.

D. Analog Output

1. “DATA FIELD 1” is the electrical output signal and units.
2. “DATA FIELD 2” is the range of the controlled variable and engineering units.

E. Discrete Output

1. Discrete outputs can be momentary or maintained.
2. “DATA FIELD 1” is the contact closed function.
3. “DATA FIELD 2” is the contact open function.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 I/O CONFIGURATION

A. Implement the control system database fields in a consistent manner by using the following procedures:

1. Use abbreviations and acronyms already established in the Contract Documents. In particular, use the information in the I/O Point List.
2. Use only abbreviation or acronym for a word or group of words, respectively.
3. Use the same subject and word order within data fields.
4. Use the same term (phrase, word, or acronym) to denote the same meaning. Do not use multiple terms for a single meaning.
5. Use the point names, descriptions, logic state descriptions, ranges and units of measurement exactly the same wherever the point is referenced.
6. Show point names and descriptions for all point references on documentation.
7. Spell correctly.
8. Maintain lists of acronyms and abbreviations used.

3.02 I/O HARDWARE CONFIGURATION

A. Partition the I/O among cards within an I/O enclosure to provide control loop integrity.

1. Put all inputs of the same I/O type associated with a device (e.g., pump, blower, clarifier or other piece of equipment) on the same card.

2. Put all inputs of the same I/O type for devices arranged in process trains (e.g., a pump, its inlet valve and its outlet valve, or a pump and its associated macerator) on the same card or cards if more than one card is required to accommodate the points.
3. Put all outputs of the same I/O type associated with a device or group of devices in a process train on the same card or cards if more than one card is required to accommodate the points.
4. Where the preceding requirements specified in this paragraph would cause more than 20% spare points on a card, points for a device or process train may be split between two consecutive cards.
5. Make unused terminals resulting from partitioning the I/O into pre-wired spares. Provide pre-wired spare points with all cabling and termination internal to the DCU as done for other I/O points.

3.03 POINT DATA FIELDS

A. I/O point data fields may be subject to review and modification by the Engineer during the Shop Drawing review phase. Incorporate changes directed by the Engineer completely into the entire system, at no additional cost to Owner, subject to the following limitations:

1. Limit the total number of modifications to 20% of the total number of I/O points.
2. Each unique change will count as one modification. For example, modifying the description, range, and engineering unit on an analog input count as three modifications.
3. Analog input alarm limit definition will not be counted as a modification.

3.04 INPUT/OUTPUT TAGGING

A. Each tag number shall be written as follows AA I ####Y # where:

1. AA =Area/DPU or PLC Identifier.
2. I = ISA Identification.
3. #### =4 Digit Loop Number.
4. Y = Function Identifier.
5. # = Suffix (to distinguish between similar variables).

B. Area/DPU/PLC/RTU Identifier.

C. ISA Identification

1. A =Miscellaneous Analytical.
2. B =Burner, Combustion.

3. C = Chlorine Residual/Gas.
4. D = Density.
5. E = Voltage.
6. F = Flow.
7. G = Intrusion.
8. H = Hand.
9. I = Current.
10. J = Power.
11. K = Time.
12. L = Level.
13. M = Motor.
14. N = pH.
15. O = Oxygen.
16. P = Pressure.
17. Q = Quantity.
18. R = Radioactivity.
19. S = Speed, Frequency.
20. T = Temperature.
21. U = Common Alarm.
22. V = Vibration.
23. W = Torque (Weight or Force).
24. X = Hazardous Gas.
25. Y = Event, State or Presence (Switch Position).
26. Z = Position, Dimension.

D. Function Identifier

1. A = Available / In Auto (input).
2. B = Backward Rotation (input).
3. C = Full Closed (input).
4. D = Full Open (input).
5. E = Close/Energize (output).
6. H = High (input).
7. I = Input (Analog).
8. L = Low (input).
9. N = Open (output) or Control Mode (input).
10. O = Output (Analog).
11. R = Running (input).
12. S = Start (output).
13. T = Stop (output).
14. U = Malfunction (input).
15. V = Slow (output).
16. W = Slow (input).
17. X = Selector Switch (input).

E. Examples

1. MPZ0120N=Main Pump Building, Valve 0120 Position, Open Command.
2. IAT0128I = Incinerator A, Temperature Transmitter 0128, Analog Input Value.
3. STL0333L = Settled Wastewater Building, Level Switch 0333, Low Alarm (Discrete Input).

END OF SECTION

SECTION 13201
GLASS-FUSED-TO-STEEL LIQUID STORAGE TANKS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all materials, labor, tools, equipment, and appurtenances to furnish, erect, and install, complete and ready for operation, factory-coated glass-fused-to-steel leachate storage tanks as indicated on the Drawings and specified in this Section. Tanks shall be installed in the locations specified on the Drawings.

B. See Division 1, General Requirements, which contains information and requirements that apply to the work specified.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. At a minimum, provide the following materials:

1. Catalogue information and catalogue cuts.
2. Detailed erection drawings and materials specifications signed and sealed by a Registered Professional Engineer licensed in Florida shall be submitted for record purposes.
3. Complete set of structural calculations for the structure signed and sealed by a Registered Professional Engineer licensed by Florida shall be submitted for record purposes. The Contractor shall obtain foundation requirements from the tank manufacturer.
4. The tank manufacturer and installing contractor’s warranty information and warranty period dates.

B. Submit tank layout drawings showing dimensions, wall thickness, mounting brackets, nozzle locations and orientation, and nozzle construction. The Contractor shall provide the manufacturer’s component weights, anchor bolt designs, and weight of the storage tank (both empty and full of liquid).

C. Submit certification that the glass coating, sealer, and bolt head encapsulation materials are suitable for exposure to the stored trucked landfill leachate with quality as shown in Table 13201-1.

D. Submit the manufacturer's design calculations for structural design of walls and design of tie-down lugs (number and size/signal), signed and sealed by a registered Professional Engineer licensed in Florida.

E. The Contractor shall submit the tank manufacturer's structural calculations for tank design, including hold-downs and anchor bolt maximum shear and tension values for review. Calculations shall be signed and sealed by a registered Professional Engineer licensed in Florida. The anchor bolt hold-down calculations shall provide an anchorage force that is greater than the buoyancy force of the empty tank in the prescribed secondary containment structure flooded to the top of wall.

F. Submit a cathodic protection system design signed and sealed by a Registered Professional Engineer that is a NACE-certified Cathodic Protection Specialist. The design submittal is outlined in Part 2.03B of the Specifications.

G. Submit a compliance report for the cathodic protection system signed and sealed by a Registered Professional Engineer that is a NACE-certified Cathodic Protection Specialist. The compliance report is outlined in Part 2.03C of these Specifications.

1.03 WORK SEQUENCE

A. See Section 01815, Maintenance of Plant Operation and Sequence of Construction.

1.04 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

B. American National Standards Institute (ANSI)

C. American Society for Civil Engineers (ASCE)

1. ASCE 7—Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.

2. ASTM A1008/A1008M—Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
3. ASTM A1011/A1011M—Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
4. ASTM C282—Standard Test Method for Acid Resistance of Porcelain Enamels (Citric Acid Spot Test).
5. ASTM D1751—Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
6. ASTM D5162— Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates.

E. American Water Works Association (AWWA)

1. AWWA D103—Factory-Coated Bolted Steel Tanks for Water Storage.

F. Florida Building Code (FBC)

G. International Organization for Standardization (ISO)

1. ISO 9001—Quality Management Systems – Requirements.

H. National Association of Corrosion Engineers (NACE)

1. NACE SP0196—Galvanic Anode Cathodic Protection of Internal Submerged Surfaces of Steel Water Storage Tanks.

I. National Fire Protection Agency (NFPA)

1. NFPA 780—Standard for the Installation of Lightning Protection Systems.

J. Occupational Safety and Health Administration (OSHA)

1.05 QUALITY ASSURANCE

A. The Contractor shall coordinate all products specified under this Section. All products shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the products to be furnished. The products shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed. The Contractor shall ensure that

installation results in an integrated system in which the various products are compatible.

B. All products furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of manufacturing and servicing the products and systems specified in this Specification for a minimum of 10 years.

1.06 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. The Contractor shall provide a manufacturer's warranty for the storage tanks and appurtenances, cathodic protection system, tank materials, tank coatings, and tank erection/installation for 1 year after leachate is first introduced into the tank.

C. The warranty shall ensure that during the warranty period the Contractor shall provide the services of a trained representative to make all adjustments and repairs and replace all defective equipment at no cost to the Owner.

D. The warranty shall ensure that the Contractor shall bear all costs incurred under the terms of the warranty, including travel and housing/dining expenses.

E. Products shall be warranted to be free from defects in workmanship, design, and materials. If any part of the product fails during the warranty period, it shall be replaced or repaired at the Contractor's option and the unit(s) restored to service at no expense to the Owner.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. The Contractor shall require the manufacturer to assume responsibility for packaging to prevent normal transit and handling damage to the tank components.

C. All approved glass-fused-to-steel panels shall be protected from damage before packing for shipment.

D. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion during shipment.

E. Individual stacks of panels will be wrapped in heavy-mil black plastic and steel banded to special wood pallets built to maintain the roll-radius of the tank panels and minimize contact or movement of finished panels during shipment.

F. Shipment from the factory to the job site will be by truck hauling the tank components exclusively. No common carrier, drop, or transfer shipments are allowed.

1.08 QUALIFICATIONS

A. The tank manufacturer shall be a single entity that designs and fabricates all components of the glass-fused-to-steel tanks specified in this Section in the United States. The manufacturer shall be a firm with at least 10 years' experience in the design and fabrication of glass-fused-to-steel tanks and shall give satisfactory evidence that it has the skill, reliability, and financial stability to guarantee the tank in accordance with the quality required by these Specifications.

B. The installer shall be a single entity that erects all components of the glass-fused-to-steel tanks specified in this Section and shall be a licensed Florida Contractor. The installer shall be a firm with at least 10 years' experience in the erection of glass-fused-to-steel tanks, having installed a minimum of 10 tanks in the last 10 years, and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build the tank in accordance with the quality required by these Specifications.

C. The manufacturer shall retain a full-time registered Professional Engineer, who shall have no fewer than 10 years' experience in the design of glass-fused-to-steel tanks and who shall be the responsible engineer in charge of the design work to be done. All working drawings shall carry the seal, signature, and date of the Professional Engineer licensed in Florida.

1.09 TESTING REQUIREMENTS

A. Chemical Resistance of Glass Coating

1. Every batch of component glass frits shall be individually tested in accordance with ASTM C282.
2. The Contractor shall test coated sheets for glass mil thickness using an electronic dry film thickness gauge (magnetic induction type). The gauge shall have a valid calibration record.
3. Test frequency shall be every tenth sheet to verify the specified coating thickness.

B. Coated sheets shall be checked for exterior color uniformity by an electronic colorimeter. The colorimeter shall have a valid calibration record.

C. The manufacturer shall perform an electrical leak detection test on the inside surface after fabricating each sheet using a 1,000-volt dry test. Frequency of the test shall be every sheet. Any sheet registering a discontinuity on the interior sidewall or floor panel surface shall be rejected.

D. Written confirmation that the following test has been passed at the place of manufacture:

1. One coated sheet per each gauge lot run shall be tested for fishscale by placing the test sheet in an oven at 400°F for 1 hour. The coating shall be examined for evidence of fishscaling. Any sheet exhibiting fishscale shall be rejected and all sheets from the gauge lot then tested or the entire gauge lot shall be rejected.

1.10 RECORD DRAWINGS

A. Record drawings shall be furnished as specified in Section 01785, Record Documents.

1.11 DESIGN CRITERIA

A. Each factory-coated glass-fused-to-steel bolted tank shall have a nominal inside diameter of 25 feet with a nominal sidewall height of 24 feet.

B. The capacity of each tank with zero freeboard shall be at least 90,000 gallons (U.S.) and a minimum usable capacity of 80,000 gallons (U.S.) with 12-inch freeboard.

C. The materials, design, fabrication, and erection of the bolted tanks shall conform to AWWA D103-09.

D. The tank coating system shall conform solely to Section 10.4 of AWWA D103.

E. The tank and its anchorage system shall be designed for empty and full tank conditions using a leachate specific gravity of 1 and ambient temperature.

F. At a minimum the tank and its anchorage system shall be designed in accordance with FBC requirements supplemented by ASCE 7 for wind loading requirements:

1.	Basic Wind Speed, mph	150
2.	Importance Factor	1.5

3.	FBC Exposure	C
4.	ASCE 7 Exposure	C

G. At a minimum the tank shall be designed to be suitable for exposure to the stored trucked landfill leachate with example quality as follows:

1. Classical Parameters:

a.	Ammonia as N	230 – 850 mg/L
b.	Biological Oxygen Demand	230 – 1,500 mg/L
c.	Chemical Oxygen Demand	2,300 – 15,000 mg/L
d.	Chloride	1,000 - 1,600 mg/L
e.	Total Alkalinity as CaCO3	500 – 1,500 mg/L
f.	Total Dissolved Solids	2,500 – 5,000 mg/L

2. Field Parameters:

a.	Dissolved Oxygen	0.23 mg/L
b.	Oxidation Reduction Potential	98.8 mV
c.	pH	5–9
d.	Temperature	16.26° C

3. Volatile Organic Compounds:

a.	2-Butanone	1,100 µg/L
b.	4-Methyl-2-pentanone	13 µg/L
c.	Acetone	480 µg/L

4. Heavy Metals:

a.	Antimony	8.78 µg/L
b.	Arsenic	17.3 µg/L
c.	Barium	56.9 µg/L
d.	Chromium	82.0 µg/L
e.	Cobalt	24.3 µg/L
f.	Copper	5.57 µg/L
g.	Iron	3,430 µg/L
h.	Nickel	96.2 µg/L
i.	Sodium	890 mg/L
j.	Vanadium	50.2 µg/L
k.	Zinc	128 µg/L

PART 2 PRODUCTS

2.01 MATERIALS

A. Tank Shell

1. Plates and sheets used for construction of the tank shell shall comply with the minimum standards of AWWA D103, Section 2.4.

2. Steel Design Requirements shall be as follows:

   a. Mild steel shall be ASTM A1011/A1011M, Grade 30 with tensile stress of 18,000 psi (maximum allowable).
   b. High-strength steel shall be ASTM A1008/A1008M, Grade 50 with tensile stress of 30,000 psi (maximum allowable).
   c. Rolled structural shapes shall conform to ASTM A36/A36M or AISI 1010.
   d. The annealing effect created from the glass-coated firing process shall be considered in determining ultimate steel strength. In no event shall a yield strength greater than 50,000 psi be used for calculations detailed in AWWA D103, Sections 3.4 and 3.5.
   e. When multiple vertical bolt line sheets and plates of ASTM A1011/A1011M Grade 50 are used, they shall be manufactured so that holes are staggered in the vertical bolt lines and that no two adjoining holes are in-line horizontally, except at the center of the sheet or plate; and the effective net section area shall not be taken as greater than 85% of the gross area.
   f. Sheet edges of sidewall plates shall be mechanically beveled and either applied with EDGECOAT II technology, providing glass encapsulation on all four sides of the sheet, or ARC flame coated with 1.5 to 5 mils 316 stainless steel before glass coating. Glass coating of the sheet edges shall be similar to the flat panel surfaces. The process shall be EDGECOAT™ by Engineered Storage Products Company or equal.

3. Bolts used in tank lap joints shall be 1/2-inch 13UNC - 2A rolled thread and shall meet the minimum requirements of AWWA D103, Section 2.2.

4. Bolt Encapsulation shall be as follows:

   a. High-impact polypropylene co-polymer of natural resins with UV (Ultraviolet) light inhibitor only. Color to be black.
   b. Entire bolt head up to the splines on the shank.

c. All tank shell bolts shall be installed so that the head portion is inside the tank and the washer and nut are on the exterior.
d. All lap joint bolts shall be properly selected so that threaded portions will not be exposed in the "shear plane" between tank sheets. Also, bolt lengths shall be sized to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.
e. All lap joint bolts shall include a minimum of four splines on the underside of the bolt head at the shank to resist rotation during torquing.
f. Polyethylene co-polymer “bolt caps” and sealant shall be used to cover the bolts, nuts, and washers exposed on the outside of the tank sidewall.

5. Sealants used to seal lap joints and bolt connections shall be as follows:

a. One-component, moisture-cured, polyurethane compound. The sealer shall not be used as a coating except for minimal exposed panel edges for the embedded starter ring, notches of sidewall panels, and edges exposed for nozzle connections. The sidewall panel edges shall be protected by the fused glass coating (spray or brush on coatings are not acceptable). The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coating, have low shrinkage, and be suitable for interior and exterior exposure.
b. Curing rate at 73° and 50% RH.
c. Tack free: 6 to 8 hours.
d. Final cure: 10 to 12 days.
e. Sealant shall be supplied by CST Industries, Inc., Engineered Storage Products Company, or equal.
f. Neoprene gaskets and tape-type sealer shall not be used.

6. Glass coating applied to steel shall meet the following minimum requirements:

a. Steel sheets prepared for coating shall be steel grit-blasted on both sides to SSPC-10. Sand blasting and chemical pickling of steel sheets is not acceptable. Before the coating system is applied, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying. Sheets shall be inspected for traces of foreign matter, soil particles, grease, or rust. Any sheets with any such substances shall be recleaned or grit-blasted to an acceptable level of quality.

b. All sheets shall be primed with catalytic nickel oxide glass ground-coat on both sides and then air dried in accordance with Section 12.4.2.1 of AWWA D103.
c. Both sides of the sheet shall receive an intermediate coat of cobalt blue glass frit.
d. The sheets shall receive a final white coat of milled titanium dioxide reinforced silica glass coating on the interior surface.
e. The sheets shall then be fired at a minimum temperature of 1,500º F in accordance with the manufacturer's ISO 9001 quality process control procedures, including firing time, furnace humidity, and temperature control.
f. Dry film interior and exterior coating thickness shall be between 6.0 to 19.0 mils.
g. The finished exterior color shall be standard cobalt blue.
h. All panels shall be adequately protected from damage during shipment and storage.

7. Horizontal wind stiffeners shall meet the following minimum requirements:

a. Wind stiffeners shall be of the “web truss” design with extended tail to create multiple layers of stiffeners, permitting wind load to be distributed around the tank.
b. Web truss stiffeners shall be of steel with hot-dipped galvanized coating.
c. Rolled-steel angle stiffeners are not permitted to be used as intermediate stiffeners.

2.02 ACCESSORIES

A. The Contractor shall ensure that all connections to the tank are designed and furnished by the tank supplier to preclude corrosion at each connection.

B. The Contractor shall furnish and install an outside tank free-standing 70-foot minimum aluminum bridge spanning between the outside of both tanks with a two flight-stair and mid landing to meet OSHA requirements as indicated on the Drawings and/or as required by the tank manufacturer. The design shall include design calculations and drawings, signed and sealed by a registered Professional Engineer licensed in Florida.

C. Furnish and install the following near the free-standing aluminum bridge:

1. 14 columns and bases.
2. Aluminum two-line mechanical guardrails at bridge perimeter.
3. Aluminum two-line mechanical guardrail with an ADA handrail at stairs.

D. The Contractor shall furnish and install a properly sized vent assembly in accordance with AWWA D103 above the maximum leachate level. The overflow pipe shall not be considered to be a tank vent. The vent shall be constructed of aluminum and designed to prevent rainwater entry and to prevent the entrance of birds and/or animals by including an expanded aluminum screen (1/2 inch) opening. An insect screen of 23- to 25-mesh polyester monofilament shall be furnished and installed.

E. Furnish and install at a minimum a 30-inch-diameter sidewall access manway in accordance with AWWA D103. The manway shall include a properly reinforced frame and cover plate. A tank-mounted stainless steel davit to hold and handle the cover plate, when open, is required unless the cover is removable.

F. The manufacturer's nameplate with serial number, tank diameter, tank height, and maximum capacity.

G. The Contractor shall furnish and install leachate inlet pipe, leachate outlet pipe, tank overflow pipe, and sump as shown on the Drawings.

H. The liquid storage tank shall contain an overflow piping system, 6 inches in diameter, of polyvinyl chloride construction. The overflow pipe downcomer shall be installed outside of the leachate storage tank with the tank sidewall flanged steel nozzle penetration within 30 inches of the top of the sidewall of the tank. The overflow inlet inside the tank shall consist of a 13.5-inch-diameter flare end flange fitting positioned vertically so that there are 6 inches of freeboard from the top of the flare to the top of the tank sidewall. Stainless steel standoffs shall be used to support the overflow pipe. A 90° elbow shall be installed at the bottom of the overflow pipe. The overflow piping configuration shall match the Drawings.

I. A float-operated liquid level indicator shall be provided on the exterior of the tank. The level indicator shall be a full-travel, direct-read-type gauge with an accuracy of plus or minus 1 inch. All interior components (i.e. float and float cables) shall be stainless steel. The exterior gauge board shall be galvanized steel with a graduated vinyl face. The scale on the vinyl face of the gauge board shall be graduated in large 1-foot increments. Bolt-on brackets shall be provided to attach the gauge board to the tank wall. A large "red" pointer shall be provided to indicate the tank liquid level. The liquid level indicator shall be as manufactured

by Engineered Storage Products Co. of DeKalb, IL or Tank Products, Inc. of Ontario, CA, or approved equal.

J. The Contractor shall furnish and install an alarm limit switch to connect to and operate with the level sight gauge. The limit switch shall provide a minimum of two single-pole double-throw (SPDT) switches that actuate on a user-defined tank level. The alarm limit switch shall be Varec 2557 or approved equal. The audible alarm and flashing light will activate when the liquid level exceeds the elevation of 6 inches below the inlet elevation of the overflow pipe.

2.03 CATHODIC PROTECTION SYSTEM

A. The Tank Manufacturer may provide their own cathodic protection system and warranty it in accordance with the requirements of this Section and Division 1, General Requirements. Otherwise the following shall apply:

1. Each leachate storage tank shall be furnished and installed with a passive, sacrificial anode cathodic protection system. The cathodic protection design/install constructor shall provide all engineering services, materials, equipment, labor, and supervision for the installation of the cathodic protection system for protecting uncoated steel surfaces exposed to the contained liquid. The cathodic protection system shall control corrosion and protect the portions of the tank structures immersed in liquid.
2. The cathodic protection design shall be prepared by a Registered Professional Engineer that is a NACE-certified Cathodic Protection Specialist. The Specialist shall have at least 20 years of documented experience designing cathodic protection systems for water process vessels. The design submittal shall include calculations, material list, product data sheets, detailed installation plans, a design analysis narrative, and the résumés of the Specialist and Technician. Sacrificial anodes shall be equally spaced (to the nearest vertical bolt line) around the tanks, attached to the floor, and bolted through tank shell sheet bolt holes. Buss bars shall be used to ensure continuity between the tank shell sheets. All electrical connections inside the tank shall be protected against corrosion by application of a sealer. Sacrificial anodes shall be manufactured from magnesium or zinc alloys that are formulated specifically for this use. Installation shall require use of sacrificial anodes with lead wires that connect to a collector cable terminating in a test box with a tank connection cable, a tank test lead, a shunt, and a reference electrode lead. The shunt shall be placed in an easily accessible location to facilitate measuring the current output of the system by facility personnel. Sacrificial anode current capacities used in system life calculations for any sacrificial anode shall not exceed the consumption rate values given in NACE SP0196 Table 1. After the cathodic protection system is installed,

the sacrificial anode corrosion protection system shall be able to provide sufficient current to protect the tank for the full design life of the system, including anticipated coating deterioration.

3. Once the tank is placed in service, the cathodic protection system shall be tested to ensure that effective corrosion control is achieved. Tests shall be conducted by a NACE-certified Technician Level I. The system will be inspected to determine if adjustments are required to maintain control of internal corrosion of the tank. Before inspection the tank must have been in use with typical liquid totally covering the anodes for at least 4, but not more than 30, consecutive days. The tests shall be conducted using an LC-4 voltmeter and a copper/copper-sulfate reference cell. Anode current output measurements shall be determined by measuring the voltage between the two outstanding legs of the lead wire assemblies used to electronically connect the anodes to the tank. The anode open circuit potential shall be measured by placing the reference electrode with submersible adapter and lead wire into the stored liquid and measuring the potential between the reference electrode and the core rod of the disconnected anode. The tank potential shall be measured by placing the reference electrode with submersible adapter and lead wire into the stored liquid and measuring the potential between the reference electrode and the tank using a multimeter. The criteria for acceptance shall include the following: Anode current output shall not exceed +0.28 m Volt for magnesium anodes (+1.62 m Volt for zinc anodes) and shall not be lower than 0.1 m Volt for any anodes; tank "OFF" potential readings shall not be less negative than -850 m Volts. If any values fail to meet criteria, the Contractor shall investigate and correct the lack of protection at no cost to the Owner. The corrections may involve coating repairs and/or anode additions.
4. Once all points tested meet NACE criteria, the Specialist shall issue a compliance report with all field data, analysis of the data, record drawings, and a statement that NACE criteria have been achieved. The Specialist shall sign and seal the report and drawings. A proposal with firm fixed costs to conduct annual compliance tests for 5 years shall also accompany the report.

2.04 MANUFACTURER

A. The tanks shall be Model 2524 Aquastore as manufactured by Florida Aquastore & Utility Construction, Inc., Boca Raton, Florida, or equal.

2.05 PIPING CONNECTIONS

A. Pipe connections shall be located and sized to match the Drawings and as necessary to meet the tank manufacturer's requirements.

B. Pipe connection end joints shall be either interior or exterior flange assemblies with appropriate gaskets.

C. Openings in the tank wall for pipe connections shall be field located, saw cut, and use an interior and exterior flange assembly bolted to the tank wall. A single component urethane sealer shall be applied on the cut panel edges and field-drilled holes.

PART 3 EXECUTION

3.01 SHIPMENT INSPECTION

A. After the tank components are delivered to the site, the Contractor and the Owner's Representative shall check the components for dents and other damage. Particular care shall be taken in handling to avoid abrasion of or other damage to the coating system.

3.02 FOUNDATION

A. The tank foundation is a part of the basin and shall be constructed as shown on the drawings by the Contractor.

B. Copies of the geotechnical reports relative to bearing capacities of the soils shall be made available by the Owner or Engineer for review by the Contractor. All other investigations needed shall be performed by the Contractor and their cost included in the project bid price.

C. The tank manufacturer shall design the tank footing ringwall. Tank anchor bolts shall be cast in the ringwall. The Contractor shall be responsible for placing anchor bolts. The Contractor shall employ an installation specialist to ensure proper placement of anchor bolts according to the tank manufacturer's certified construction/erection drawings before casting them in concrete.

3.03 TANK FLOOR

A. The floor design is glass-coated bolted steel. Bolted steel panels shall be placed over a non-extruding and resilient bituminous type filler meeting the requirements of ASTM D1751 and set on a concrete slab.

B. Polyethylene co-polymer encapsulated nuts and sealant shall be used on the inside of the floor. The leveling of a new starter ring shall be in accordance with the tank manufacturer's requirements and the maximum differential elevation within the ring shall not exceed 1/8-inch nor exceed 1/16-inch within any 10 feet of length.

3.04 TANK INSTALLATION

A. The Contractor shall install tanks level as shown on the Drawings.

3.05 SIDEWALL STRUCTURE

A. Field erection of the glass-coated, bolted steel tank shall be in accordance with the procedures in the tank manufacturer's erection manual.

B. Erection shall be performed by the tank manufacturer's authorized erector who has installed a minimum of 20 glass-fused-to-steel tanks within the last 10 years.

C. Particular care shall be taken in handling and during construction to avoid abrasion of or other damage to the coating system.

3.06 ELECTRICAL GROUNDING

A. An electrical grounding system shall be designed by a Florida Registered Professional Engineer to withstand direct lightning strikes without damage and furnished and installed in accordance with Section 7.4.1.4 (C) of NFPA 780 using three ground terminals at approximately 30-foot intervals around the perimeter of the tank.

3.07 FIELD TESTING

A. Electrical testing shall be used during and after erection to locate damage to the coating system. Repair/touch-up work shall be in accordance with the manufacturer's recommendations.

B. Before the hydrostatic testing, the Engineer and the Owner shall examine the erected tank and repairs/touch-up as required shall be completed.

C. After erection, cleaning, and the Engineer and Owner's examination, each tank shall be hydrostatically tested.

1. The tank shall be filled with water to a point no less than 6 inches from the top of the tank sidewall with the overflow temporarily flanged for 48 hours.
2. Any leaks disclosed by this test shall be corrected by the erector in accordance with the tank manufacturer's recommendations.
3. Water used for the hydrostatic test shall be supplied by the Contractor.
4. Water used for the hydrostatic test shall be disposed of on-site as directed by the Engineer.

D. Labor and equipment necessary for tank testing is to be included in the Contractor's bid.

3.08 CERTIFICATION

A. The Contractor shall provide a written certification that the storage tanks have been properly installed according to the Contract Drawings, Specifications, and manufacturer's specifications/instructions and shall ensure that the tanks are functioning normally. Make all corrections and adjustments as necessary to achieve such certification at no additional cost to the Owner.

3.09 INSPECTION

A. On or within 3 months after the 1-year anniversary date of initial tank use, the tank erector shall conduct a visual inspection of the interior and exterior of each tank. The Owner is responsible for draining and cleaning out the tank before the arrival of the tank erector's inspector. The Owner is also responsible for all requirements necessary for entry into the tank under OSHA confined-space rules. A written report of the inspection of each tank's condition shall be delivered to the Owner within 30 days of the inspection.

END OF SECTION

SECTION 13206
SODIUM HYPOCHLORITE STORAGE TANKS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to fabricate and install sodium hypochlorite vertical bulk storage tanks as shown on the Drawings. The tanks shall be constructed of Metallocene High-Density Cross-Linked Polyethylene (MHDXLPE), or High-Density Impact-Resistant Linear Polyethylene (HDLPE), and designed for storing 15% sodium hypochlorite solution.

B. The storage tanks specified in this Section shall be supplied by the supplier of the sodium hypochlorite disinfection system as specified in Section 11260, Chemical Metering Umps and Skid Systems.

C. The Contractor shall coordinate the location of the storage tanks with the sodium hypochlorite disinfection system.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply. The publications listed below form a part of this Section to the extent referenced:

A. American National Standards Institute (ANSI)

1. ANSI B16.5—Piping Flanges and Flanged Fittings.

B. American Society of Testing Materials (ASTM)

1. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
2. ASTM D648—Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
3. ASTM D746—Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

4. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
5. ASTM D883—Standard Terminology Relating to Plastics.
6. ASTM D1505—Standard Test Method for Density of Plastics by the Density-Gradient Technique.
7. ASTM D1525—Standard Test Method for Vicat Softening Temperature of Plastics.
8. ASTM D1693—Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
9. ASTM D1998—Standard Specification for Polyethylene Upright Storage Tanks – Section 11.3: Low Temperature Impact Test and Section 11.4: Oxylene-Insoluble Fraction (Gel Test).

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for a minimum of 1 year. The warranty period shall begin at the date of substantial completion.

1.06 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall the meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. Tanks shall be rotationally-molded, vertical IMFO®, metallocene high-density crosslinked polyethylene or HDLPE resin, one-piece seamless construction, cylindrical in cross-section and vertical with flat bottoms. Tanks shall be adequately vented as prescribed in Poly Processing Company's Technical Bulletin, *Venting Vertical Storage Tank*, dated January 2010, or Snyder Industries Installation Manual and, where indicated, tanks shall be provided with entrance manways. Tanks shall be marked to identify the manufacturer, date of manufacture, and serial number.

B. Plastic: The tanks shall be molded from MHDXLPE or HDLPE . The resin used shall be Paxon 7004 as manufactured by Exxon/Mobil Chemical or type HDPE HD 8660 manufactured by Exxon/Mobile Chemical. Interior primary tank shall have an anti-oxidant resistant OR-1000™ liner.

C. Fillers and Pigments: The plastic shall not contain any fillers. All plastic shall contain a minimum of 0.25% and maximum of 0.60% U.V. stabilizer. Pigments added shall not exceed 0.5% of the total weight of the tank if dry blended or 2% if melted compound. Tank color shall be opaque white in color for 15% sodium hypochlorite storage.

D. The storage tanks shall be provided with one prominently marked 18-inch-x-18-inch (minimum) sign stating "DANGER—SODIUM HYPOCHLORITE."

E. All MHDXLPE or HDLPE tanks shall be constructed by the rotational molding process.

F. All MHDXLPE or HDLPE tanks shall be capable of storing 15% sodium hypochlorite solution at 100ºF.

G. All MHDXLPE tanks shall be constructed with an anti-oxidant-resistant OR1000™ liner and flanged outlet.

H. The nominal properties of the sodium hypochlorite tank materials are as follows:

Test Procedure	Units	Value
Density/ASTM D1505/ASTM D4883	g/cc	.940 to .945
ESCR Cond. A, F50/ASTM D1693 10% Igepal	Hours	50 to 1,000
Tensile Strength/ASTM D638	psi	2,600 to 3,000
Elongation at Break 2.0-inch/min/ASTM D638	Percent	400

Test Procedure	Units	Value
Vicat Softening Temperature/ASTM D1525	Degrees F	240
Brittleness Temperature/ASTM D746	Degrees F	-130
Flexural Modulus/ASTM D790	Psi	100,000 to 130,000
Heat Distortion Temp./ASTM D648 at 66 psi	Degrees C	67°
Low Temperature Impact ARM-Low Impact for 1/8-inch specimen	Feet lb	75
Polyethylene Notch Test (PENT) ASTM F1473 (176°F, 350 psi)	Hours	>1,000
Long-Term Hydrostatic (LTHS) (Creep) at 140°F	psi	900

I. The tank diameter shall be measured externally. Tolerance on the outside diameter, including out of roundness, shall be plus or minus 3%. Measurement shall be taken in a horizontal position. The knuckle radius at bottom to wall shall be a minimum of 1 inch.

J. The minimum wall thickness shall be 1/4 inch in all places. All edges cut shall be trimmed smooth. Use flexible connections at all lower sidewall fittings.

K. The manufacturer shall furnish and install all precautionary labeling as recommended by the Manufacturing Chemists Association for the chemical(s) to be stored.

2.02 DETAILED SPECIFICATION – BULK 15% WT SODIUM HYPOCHLORITE STORAGE TANKS

A. Design Requirements:

1. Number of Tanks: Two.
2. Maximum Tank Outside Diameter: 8 feet.
3. Nominal Tank Capacity: 2,500 US gallons.

B. Manway Cover: Top manway cover shall be at least 19 inches inside diameter. The manway cover shall be a bolt-on-type or screw-on-type lid manufactured out of XLPE or HDLPE. Provide a Viton or EPDM gasket. All bolts used to mount the manway cover shall be titanium or a compatible non-metallic material. The manway shall include a surge-relief feature as additional protection from over-pressurization.

C. Access Ladder: Provide one fiberglass external access ladder to allow personnel to access the manway cover at the top of the bulk storage tanks.

1. The ladder for the bulk storage tanks are not accurately shown in the Drawings. The Contractor shall coordinate ladder location with the Owner before submitting shop drawings for these tanks.
2. The cage ladder shall be in accordance with OSHA standards. The bulk storage tanks shall be furnished with all lugs required for mounting the ladder as specified by the tank manufacturer.

D. The Contractor shall provide galvanized steel hold-down clips, anchor bolts, and hardware to secure the tanks to the concrete slab. The hold-down system shall be designed to meet 150-mph wind-load conditions.

2.03 ACCESSORIES

A. All tank accessories specified in this Section shall be furnished by the tank manufacturer. These tank accessories are not shown on the Drawings. The Contractor shall coordinate the location of these accessories with the Owner before submitting shop drawings for the tanks.

B. Hold-Down Devices: All hold-down devices (clips, bolts, and accessories) shall be galvanized steel and shall be provided to securely anchor the tank to the tank concrete pad in accordance with the local seismic zone and 150-mph wind-load ratings.

C. Fittings: All openings (fittings) shall be either IMFO (Integrally Molded Flanged Outlet) outlets, SUMO (Snyder Utilized Molded Outlet), or constructed of Schedule 80 PVC. Flanged fittings that shall be directly exposed to sodium hypochlorite shall be furnished with latharge fittings Viton (side wall) and EPDM (dome-mounted fittings) gasket for fittings not directly exposed to the chemical. Threaded fittings are not acceptable.

1. All nozzles shall be furnished with a 150-pound ANSI flange constructed of PVC with titanium bolts, nuts, and washers. The gasket shall be Viton for chemical exposure (conditions noted above).

D. Vents: All vents shall be constructed of PVC. Provide a non-metallic insect screen compatible with 15% wt sodium hypochlorite on each tank vent.

E. Reverse Float Level Indicator: The float level gauge shall be constructed with a guided float on the inside of the tank connected to a weight indicator on the exterior of the tank with a 1/4-inch rope. The weighted indicator shall move alongside a clear guide pipe equipped with a gallonage indicator board made of

PVC material attached to the clear guide pipe. The board shall be stenciled with 100-gallon marks and labeled every 500 gallons. The level gauge shall be connected to the tank dome with 3-inch threaded bulkhead fittings and held along the tank sidewall with appropriate 1-inch fittings and stand-off connections.

1. The float level gauge rigid components shall be constructed of PVC or other specified material. The rope shall be constructed of polypropylene. Gaskets shall be constructed of EPDM or Viton.
2. The reverse float level indicator shall be manufactured by Snyder Industries Inc. or Engineer-approved equal.

2.04 SODIUM HYPOCHLORITE TANK MANUFACTURER

A. The bulk storage tanks shall be single-wall, vertical tanks as manufactured by Poly Processing Inc. or Snyder Industries Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install tanks in accordance with the Contract Documents and the manufacturer's instructions.

B. Following the field test, tanks and support members shall be anchored in their final position according to the manufacturer's recommendations.

3.02 FIELD TESTING

A. After installation, the tank connecting pipes and valving shall be field tested by being completely filling with potable water. The tanks and fittings shall hold water without loss, evidence of weeping, or capillary action for 24 hours before being accepted. The Engineer may also inspect the tanks for defects, damage, and conformance with the Specifications.

B. After testing, the tanks shall be drained, thoroughly cleaned, and dried.

C. Should any defects become evident during inspection, testing, or within the warranty period, the Contractor shall repair or replace the defective tank or fitting as approved by the Engineer.

3.03 CLEANING AND PROTECTION

A. The Contractor shall replace all tank components damaged during tank delivery and installation at no expense to the Owner.

3.04 COORDINATION

A. The Contractor shall verify concrete pad plan dimensions to suit the tanks specified in this Section before forming and pouring concrete pads. The Contractor's failure to verify tank dimensions before installing these pads shall require a new concrete pad at the Contractor's sole expense.

B. Concrete pad foundations and floor are to be constructed generally as shown in the Drawings and specified elsewhere.

C. The concrete pad shall be notched at the location of the IMFO fitting to prevent interface with the IMFO.

END OF SECTION

SECTION 13300
PLANT MONITORING AND CONTROL SYSTEM TRAINING

PART 1 GENERAL

1.01 REQUIREMENTS AND RESPONSIBILITIES

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform and coordinate all required training at times acceptable to the Owner and Engineer.

B. The Contractor shall retain the services of the Process Instrumentation and Control System (PICS) Supplier to provide operational and maintenance training for all process, monitoring and control equipment as specified herein.

C. The PICS Supplier shall provide for on-site training by an authorized representative of the equipment manufacturer as part of the Supplier's services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.

D. The Contractor and the PICS Supplier shall be responsible for all costs, including cost of travel, meals and lodging, for their respective equipment, if required, that is associated with training, and shall provide all required materials, texts and required supplies. A maximum of eight people will be attending training courses.

E. All training shall be conducted in the normal 8-hour working days until conclusion of the training course. For on-site training, the course instructor shall be assigned full time and shall not perform other duties throughout the period of the course.

F. Training shall occur after all other process related training in completed. The Contractor shall coordinate the training sequences.

1.02 SUBMITTALS

A. Within 60 days of the effective date of the Notice to Proceed, the Contractor and the PICS Supplier shall submit their plan for training and also conforming to the requirements of Instruction of Operations and Maintenance Personnel. Included in the plan shall be course outlines and schedules for training to be provided on-site.

1.03 GENERAL TRAINING

A. General

1. Respective contractors or suppliers shall provide supplier or manufacturer approved representative's who shall perform standardized, structured training courses at a training facility in Columbia County staffed with regular full time training instructors covering both operation and maintenance of the system equipment furnished by the Supplier or Manufacturer.

2. The Owner will send the following personnel to attend training courses at the project site.

    a. Operations Training: Four persons.
    b. Maintenance Training: Four persons.

B. Operator Training Course

1. Provide a minimum 3-day, 8 hours per day, course covering the structure and the functions of the PLCs, SCADA equipment and other system components and devices. The course shall familiarize the student with the procedures for applying the system to process control problems and develop student programming capability.

2. As a minimum, the course shall cover the following topics:

    a. Overview of systems functional capabilities.
    b. Equipment overview including system component functions, operating principals and proper use.
    c. Loading and start-up of the digital system hardware components.
    d. Use of system commands.
    e. Development of programs and control schemes.
    f. Development and use of system displays.
    g. Programming concepts and techniques.
    h. Use of bulk storage device for system backup.

C. Maintenance Training Course

1. Provide a minimum 3-day, 8 hours per day, course covering preventive and troubleshooting maintenance for the system components. The course shall familiarize the student with diagnostic capabilities of the system, both software and hardware, and also the routine maintenance procedures on the system and the common peripheral devices.

2. As a minimum the course shall cover the following topics:

a. System overview description including the power subsystems and logic components of the processor bus.
b. Description of the maintenance and troubleshooting aids of the system including software diagnostic programs.
c. Description of all bus operations.
d. Description of peripheral and process interface devices.

1.04 SPECIFIC TRAINING

A. Onsite training to begin after startup and demonstration testing process is completed.

1. Primary Sensors/Transducers and Field Instruments:

a. The services of equipment manufacturer's representatives shall be provided for a minimum of 2 hours for each type of instrument including analytical equipment.

b. Provide on-site operation and maintenance training by the Supplier and the equipment manufacturer representatives after the completion of the Startup process, conforming to the requirements of Instruction of Operations and Maintenance Personnel.

c. Training shall accomplish the following:

(1) Provide instruction covering use and operation of the equipment to perform the intended functions.
(2) Provide instruction covering procedures for routine, preventive and troubleshooting maintenance including equipment calibration.
(3) Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall plant monitoring and control system.

2. Training covering the control equipment:

a. The PICS Supplier shall provide minimum of 2 days of additional operations training covering all system components.

b. Training course shall accomplish the following:

(1) Provide all instructions necessary to operate and utilize all system components.
(2) Provide all instruction necessary to monitor and control the system processes from the designated control panel.
(3) Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
(4) Provide instructions for regular caretaking operations.

3. PLC and SCADA Training:

a. The PICS Supplier shall provide minimum of 1 day (8 hours) of additional operations training covering all PLC system components.

b. The PICS Supplier shall provide training that covers PLCs, SCADA system equipment, and the components of the network as follows:

(1) Provide an overview of system hardware and software.
(2) It shall train people in configuration, operation and programming processors.
(3) The emphasis shall be placed on how to perform set point changes, minor programming changes, range changes, diagnostics and upkeep of documentation.
(4) Instruction for hardware and software maintenance, trouble shooting and maintenance planning.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 13400
PROCESS CONTROL SYSTEM START-UP AND FIELD TESTING

PART 1 GENERAL

1.01 SYSTEM CHECK-OUT AND START-UP RESPONSIBILITIES

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all equipment and coordinate all activities necessary to perform check-out and start-up of the equipment.

B. The Contractor shall retain the services of the Process Instrumentation and Control System (PICS) Supplier to supervise and/or perform check-out and start-up of all system components. As part of these services, the PICS Supplier shall include for those equipment items not manufactured by him; the services of an authorized manufacturers' representative to check the equipment installation and place the equipment in operation. The manufacturers' representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.

1.02 CHECKOUT AND START-UP

A. The Contractor, under the supervision of the PICS Supplier, and other instrument suppliers as applicable, shall perform the following:

1. Check and approve the installation of all components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
2. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.

B. Both the Contractor and the PICS Supplier shall provide all test equipment necessary to perform the testing during system checkout and start-up.

C. The Contractor and the PICS Supplier shall be responsible for the initial operation of monitoring and control system and shall make any required changes, adjustment or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.

D. The Contractor shall furnish to the Engineer certified calibration reports for field instruments and devices specified in Section 13080, Primary Sensors and Field Instruments, and panel mounted devices specified in Section 13070, Panel Mounted Instruments and Devices, as soon as calibration is completed.

E. The Contractor shall furnish the Engineer with an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of the Contractor, and PICS Supplier.

F. The Contractor and PICS Supplier shall perform all calibrations with the Owner present. No exceptions.

1.03 INTEGRATED SYSTEM FIELD TEST

A. Following the PICS checkout and initial operation, the Contractor, under the supervision of the PICS Supplier, shall perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational. Any defects or problems found during the test shall be corrected by the Contractor and then retested to demonstrate proper operation.

B. Following demonstration of all system functions, the PICS, including field sensors/transducers and instruments, shall be running and fully operational for a continuous 48-hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48-hour integrated system test has been successfully completed and the Owner and Engineer agree that the Operation Availability Demonstration can begin.

1.04 OPERATIONAL AVAILABILITY DEMONSTRATION

A. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the system (both hardware and software) availability meets or exceeds 99.7% for 7 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the plant.

B. For the purpose of the OAD, the system will be defined as consisting of the following systems and components:

1. Plant Control Panel, PCP all remote displays all PLC panels as shown on SCADA Network drawing, provided by the PICS Supplier, and the Contractor.
2. Generator & Switchgear Control Panel and all Standby Generator panels as shown on SCADA Network drawing, provided by the Equipment Supplier.
3. Main Plant SCADA HMI software and SCADA control system changes.

C. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The OAD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 7 consecutive day OAD shall begin.

1. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
2. Recurrent hardware or software problems: If the same type of problem occurs three times or more.
3. Software problem causing a processor to halt execution.

D. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.4.E., below:

1. Failure of PLCs.
2. Loss of communications between devices on the communications network.
3. Failure of one or more input/output components.
4. Failures of any type affecting ten or more input/output points simultaneously.
5. Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.
6. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.
7. Failure of three or more primary sensors/transducers or field instruments simultaneously.

E. The system availability shall be calculated based on the following equation:

$$A = \frac{TTO}{TTO + TTR} \times 100\%$$

where: A = system availability in percent.
TTO = total time in operation.
TTR = total time to repair.

F. Time to repair shall be the period between the time that the Contractor is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.

1. Actual travel time for service personnel to get to the Site up to 6 hours per incident from the time that the Contractor is notified of a system failure.
2. Time for receipt of spare parts to the plant site once requested up to 24 hours per incident. No work shall be done on the system while waiting for delivery of spare parts.
3. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.

G. Completion of a 7-consecutive-day period without any restarts of the OAD and with system availability in excess of 99.7% will constitute acceptance of the PICS by the Owner.

H. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by the Contractor at no additional cost to the Owner. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

I. A Plant Monitoring and Control System Malfunction/Repair Reporting Form shall be completed by the plant personnel and Engineer to document system failures, to record Contractor notification, arrival, and repair times, and Contractor repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 13420
FIBER OPTIC COMMUNICATION SUBSYSTEM (FOCS)

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. This Section specifies the requirement to provide and install the fiber optic communication media, complete. Work specified herein is to be coordinated with work specified in Division 13, Special Construction.

1.02 REFERENCES

The following is a list of standards that may be referenced in this Section:

A. Telecommunications Industries Association/Electronic Industries Alliance (TIA/EIA)

1. TIA/EIA-568 C.3—Optical Fiber Cabling Components Standard.
2. TIA/EIA-598-B—Optical Fiber Cable Color Coding.
3. TIA 492AAAC—Detail Specification for 850-nm Laser- Optimized, 50-mm Core Diameter/125-MM Cladding Diameter Class IA Graded-Index Mulitmode Optical Fibers.
4. TIA/EIA-526-14-B OFSTP-14B—Optical Power Loss Measurement of Installed Multimode Cable.

B. National Electrical Code (NEC)

C. International Organization for Standardization (ISO)

1. ISO 8802-3—CSMA/CD (Ethernet).

1.03 SUMMARY

A. The function of the FOCS is to transmit digital data between network nodes. The requirements listed identify the minimum acceptable system performance. Provide all hardware and software required for operational system.

B. Provide a standards-based, multimode FOCS segment implement an industrial, Ethernet-based, network.

C. The work consists of providing, installing, terminating, and testing two OM-3 optical fiber links supporting communications between a central operations center and two process facilities located within the wastewater plant campus.

D. The requirements listed identify the minimum acceptable system performance. Provide all hardware and software required for operational system.

1.04 ABBREVIATIONS

A. ANSI: American National Standards Institute.
B. ATM: Asynchronous transfer mode.
C. AUI: Attachment unit interface.
D. dB: Decibel.
E. DNI: Desktop network interface.
F. EIA: Electronic Industries Association.
G. FDDI: Fiber distributed data interface.
H. FOA: Fiber Optic Association
I. FOCS: Fiber Optic Communication Subsystem.
J. FOIRL: Fiber Optic Inter Repeater Link.
K. LAN: Local area network.
L. m: Meter.
M. MHz: Megahertz.
N. µ: Micro, x 10-6.
O. Mbps: Megabits per second.
P. N:
    1. Newton.
    2. Nano, x 10-9.
Q. OLTS: Optical Loss Test Set.
R. OTDR: Optical time-domain reflectometer.
S. TIA: Telecommunications Industries Association.

1.05 SUBMITTALS

A. Cable Schedule Showing

    1. Cable identifications.
    2. Fiber counts for each cable and identifications of used fiber pairs.
    3. Cable length and attenuation with two connector pairs and zero splices based on TIA/EIA-568-C3. If calculation indicates that any cable will attenuate signals more than 8 dB, reroute in cooperation with the Engineer.

B. Component Submittal: For each FOCS component.

1. Manufacturer and model number.
2. General data and description.
3. Engineering specifications and data sheets.
4. Manufacturers suggested installation practice.

C. Quality Control Submittals

1. Contractor Qualifications Submittal:

a. FOCS Subcontractor Statement of Qualifications.
b. FOCS Subcontractor Site Supervisor Resume.

2. Testing-Related Submittals:

a. OLTS calibration certification.
b. Insertion Loss Test Procedures.
c. FOA Fiber Optic Technician Certification.
d. Insertion Loss Test Results.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Optical Fiber Cable

1. Outside, Underground, Submerged: 15 to 25°C.
2. Outside, Overhead: Wet/warm, 15 to 40°C.
3. Outside, Aboveground in Conduit: −20 to 40°C.
4. Inside: Wet, 0 to 40°C.

B. Other Equipment

1. Outside Aboveground: Wet/warm, −20 to 40°C.
2. Control Rooms, Equipment Rooms, and Telecommunications Closets: 30 to 55% relative humidity, 18 to 24°C.
3. Other Areas: 0 to 100% relative humidity, 5 to 35°C.

1.07 TESTING

A. Test components of the installation in accordance with standards and specifications, TIA/EIA-526-14-B OFSTP-14B as a minimum.

B. Provide equipment, instrumentation, supplies, and skilled staff necessary to perform testing. The testing technician shall have current FOA Fiber Optic Technician certification.

C. Advise the Engineer at least 48 hours in advance of each test. The Owner and the Engineer shall have option to witness and participate actively in tests. Document test results of each cable to confirm that specified number of fibers per cable meet standards.

D. Submit documented results of tests. Indicate the measured optical loss for each strand in the cable measured from both ends each.

1.08 MINIMUM FOCS CONTRACTOR QUALIFICATIONS

A. FOCS Subcontractor: Minimum of 5 years of experience providing, integrating, installing, and starting up similar systems as required for this Project.

B. FOCS Subcontractor's Site Representative: Minimum of 5 years of experience installing systems similar to FOCS as required for this Project.

PART 2 PRODUCTS

2.01 FIBER OPTIC CABLE

A. General

1. Temperature Range:

a. Storage and Operational: −40 to 70°C.
b. Installation: −30 to 70°C.

2. Suitable for outdoor and direct buried installation.

B. Multi-Mode Fiber Characteristics

1. Fiber shall comply with requirements of TIA – 492AAAC (OM3).

2. Fiber material and core/cladding size: glass, multi-mode 50/125 μm.

3. Performance:

a. Maximum Attenuation:

(1) 850 nm: 3.0 dB/km.
(2) 1,300 nm: 1.0 dB/km.

b. Bandwidth with overfilled launch:

(1) 850 nm: 1,500 MHz-km.
(2) 1,300 nm: 500 MHz-km.

c. Serial 1 Gigabit Ethernet distance:

(1) 850 nm: 1,000 m.
(2) 1,300 nm: 600 m.

4. Color coded tubes and fibers, in accordance with TIA/EIA-598-B.

5. Minimum Bend Radius, Buffer End Fiber: 1 inch.

C. Tube Configuration

1. Loose tube, gel-free with water swell-able tape and yarns.
2. Shared tube.
3. Fibers Per Tube: Six maximum.

D. Cable

1. Fiber Count: As noted on the Drawings. Six fibers per cable minimum.

2. All-Dielectric Construction: No electrically conductive components in the fiber optic cable.

3. Strength Member:

a. Nonconductive; integral part of cable; supports stress of installation and load during use.
b. Fiberglass epoxy rod aramid fiber, Kevlar.
c. Minimum Tensile Strength: 600 pounds.

4. Protective Covering:

    a. Flame-Retardant, UV resistant, Non-Halogen outer jacket.
    b. In any single length of cable continuous and free from holes, splices, blisters, and other imperfections.

5. Minimum Bend Radius:

    a. Short-Term Under Tension: 15 times cable diameter, minimum.
    b. Long-Term Without Tension: 10 times cable diameter, minimum.

6. Miscellaneous:

    a. Ripcord.
    b. Dielectric central member.
    c. Interstitial filling.

7. Manufacturers and Model:

    a. Corning Cable Systems, Altos® Lite™ Gel-Free Cable.
    b. Or Equal.

2.02 CONNECTORS

A. Features

1. In accordance with requirements of TIA/EIA-568-C3.
2. SC connectors with 12.7-millimeter spacing between ferrules.
3. Designed to support Ultra Polish Connector (UPC).
4. Pull Strength: 2.2 N minimum.
5. Durability: Sustain minimum 500 mating cycles without violating other requirements.
6. Ferrules: Zirconia.
7. Polarizing key on duplex connector systems.

B. All fibers strands per cable shall be terminated on connectors.

C. Attenuation

1. In accordance with requirements of TIA/EIA-568-C3.
2. Maximum of 0.75 dB per connector pair.

D. Maximum Return Loss Value: 55dB.

E. Manufacturer and Model

1. Corning Cable Systems TRM-31.
2. Leviton 49990.
3. Or Equal.

2.03 FAN OUT KITS

A. General: Supports field termination of loose-tube, fiber optic cables.

B. Features

1. In accordance with requirements of TIA/EIA-568-C3.
2. Suitable for outdoor application.
3. 25-inch long, 900-µm buffer tube.
4. Color coded in accordance with TIA/EIA 598 B.
5. Snap-together, plastic furcation unit.
6. Number of buffer tubes to match cable buffer tube count.

C. Manufacturer and Model

1. Corning Cable Systems FAN-OD.
2. Leviton 49887.
3. Or equal.

2.04 JUMPER CABLES (PATCH CORDS)

A. In accordance with requirements of TIA/EIA-568-C3.

B. Function: To connect from fiber centers to hubs or network nodes.

C. Fiber Characteristics: In accordance with requirements for fiber optic cable.

D. Tube Configuration

1. Individual tight thermoplastic buffer tubes.
2. Protected with Kevlar strength member sand enclosed in thermoplastic jacket.

E. Length: Standard lengths to meet project installation requirements, plus minimum 3-m spare at workstations.

F. Connectors: To meet requirements of paragraph 2.02 Connectors, and:

1. On-Axial Pull Strength: 33 N.
2. Normal-to-Axial Pull Strength: 22 N.

G. Spares: Provide 100% spare jumpers of each length needed.

2.05 TEXTILE INNERDUCT

A. Provide with each fiber optic cable a detectable textile innerduct and inflatable closure system suitable for installation in 2-inch conduit. The innerduct shall be configured with a minimum of two cells.

B. The inner duct shall be fabricated from a polyester/nylon fabric. Inside each cell shall be a flat, woven polyester pull tape that runs the entire length of the inner duct. Each tape shall be color-coded and rated for 1,250 pound pull tension, as a minimum. An 18G, TFN solid core, copper cable shall be sewn in the innerduct seam for tracing. The trace cable shall be 600 VAC rated, with a minimum ampacity of 6 A. The trace cable jacket shall be green polyvinyl.

C. The innerduct assembly shall be factory lubricated.

D. Seal each end of the conduit with an inflatable foil termination bag. The termination bag shall be the innerduct manufacturer’s standard, suitable for water-tight installations.

E. Innerduct shall be 2-inch, 2-cell Maxcell Innerduct, or equal.

PART 3 EXECUTION

3.01 INNERDUCT SYSTEM

A. Provide and install innerduct in accordance with the manufacturers’ instructions. Leave the pull tape in the innerduct’s empty cell to facilitate future cable installations.

B. Install the termination bag at each conduit open ends in accordance with the manufacturer’s instruction.

3.02 FIBER OPTIC CABLE

A. Install cables as specified and in accordance with the manufacturer's requirements.

B. Install cable directly from shipping reels. Ensure that cable is not:

1. Dented, nicked, or kinked.
2. Subjected to pull stress greater or bend radius less than specified or manufacturer's specification, whichever is the more stringent requirement.
3. Subjected to treatment, which may damage fiber strands during installation.

C. Cables per Conduit: In accordance with NEC conduit fill limitations, as shown on the Drawings, whichever is the more stringent requirement.

D. Splices

1. For segment runs 2,000 feet or shorter, install fiber optic cables in unspliced lengths throughout the system.
2. Fusion splice connection(s) may be used for segment runs greater than 2,000 feet. Submit to the Engineer for their approval the quantity and location of splice. Include with this submittal an accounting of the optical budget for the entire fiber optic segment (from transceiver to transceiver).
3. The Engineer will approve the use of splice connections on an exception basis. Splices will not be approved to correct installer error.

E. Identification

1. Identify each cable on both ends and in all access holes and pull points it goes through.
2. Use waterproof tags and identifications.

F. Sealing: Seal conduits around cable, after installation and testing, to stop ingress of water and grit.

3.03 CABLE TERMINATIONS

A. Terminate cables in accordance with TIA/EIA-568-C3.

B. Fan out fiber cable to allow direct connectorization of connectors. Sleeve over individual fibers with transparent furcation tubes. At point of convergence of furcation tubes, provide strain relief with metal or high-density plastic fan-out collar.

C. Breakout Kits

1. Terminate all cables using manufacturer-supplied breakout kits.
2. Terminate in accordance with the manufacturers' recommendations.

D. Identification: Ensure that each fiber's identification is clearly visible, or identify individually.

E. Slack

1. In Fiber Centers and at Hubs and Switches: Minimum 3-m slack fiber at each end, coiled neatly in the cable management equipment.
2. In Communications Management Outlets: Minimum 1-m slack fiber, coiled neatly in the outlet box.

F. Connectors

1. Terminate 100% fibers in each cable to specified connectors.
2. Connect connectors into fiber management system wherever possible.

3.04 CABLE TESTING

A. Provide equipment, instrumentation, and supplies necessary to perform testing. The Owner and the Engineer shall have option to observe the onsite tests.

B. Perform an Insertion Loss Test on delivery while the fiber cable is on the reel. The use of temporary termination connectors are permissible for this test. All strands must meet the requirements of TIA/EIA-526-14-B OFSTP-14B. Any fiber not meeting this requirement for all strands shall be rejected.

C. Complete cable installation and termination of all strands prior to final testing. The use of temporary termination connectors is not permissible for the final test.

D. Demonstrate that all strands in each cable meet the requirements of TIA/EIA-526-14-B OFSTP-14B, as modified here:

1. Measure attenuation in both directions, not in one direction only.
2. Measure attenuation at 850 and 1,300 nm.

E. Replace all cables that do not have specified number of fibers meeting specified attenuation standards. Re-test until cable meets requirements.

END OF SECTION

SECTION 13500
PROCESS CONTROL SYSTEM FACTORY TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. PICS Supplier shall provide all labor, materials, equipment, and incidentals as specified and required for factory testing at their respective facilities to verify that system their components function properly, compatible with each other's system and comply with the functional and performance requirements of the Contract Documents.

2. Perform factory testing on the following types of equipment:

   a. Control panels,
   b. Graphical screens on OIT's and configured OIT software provided by the PICS Supplier.

3. Perform factory testing on the process control systems for the following process equipment:

   a. Control Panel PLC-A and PLC-B.

4. The PICS Supplier shall advise the Engineer in writing of the scheduled dates for process control systems factory testing; submit such notice not less than 28 days prior to the scheduled start of factory testing. The PICS Supplier shall make all arrangements and pay all costs for six Owner/Engineer representatives to be present at their factory testing facility (located within the USA) during operational testing of the process control systems at their respective factories, either for individual units or for the integrated system. In lieu of the Owner and Engineer witnessing the process control system factory testing, the Contractor shall submit a letter, sealed and signed by a professional engineer, certifying that the required factory testing was successfully completed in accordance with testing procedure approved by the Engineer and the Contract Documents.

B. Related Sections

1. 13600, Process Control System General Provisions.

1.02 QUALITY ASSURANCE

A. Qualifications

1. Professional Engineer:

a. Engage a registered professional engineer legally qualified to practice and experienced in providing the engineering services of the kind indicated. The professional engineer may be an employee of manufacturer.

b. Submit qualifications data.

c. Responsibilities include but are not necessarily limited to:

(1) Preparing or supervising the preparation of factory test set-ups.
(2) Performing or supervising performance of factory testing, interpretation and engineering analysis of factory testing data, and preparation of test reports.
(3) Certifying that factory tests performed and results achieved comply with the Contract Documents.

B. Action Submittals: Submit the following:

1. Testing Plans:

a. Submit factory test procedures in accordance with Section 13600, Process Control System General Provisions, for all equipment listed in Paragraph 1.01.A of this Section. Obtain the Engineer's acceptance of testing plan not less than 28 days prior to scheduled start of factory test.

C. Informational Submittals: Submit the following:

1. Source Quality Control Submittals:

a. Written results of factory testing for process control systems. Submit the complete factory test report within two weeks after completion of the factory test.
b. Certification of factory testing results by professional engineer.

2. Qualifications Statements:

a. Professional engineer.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Inspections Prior to Factory Testing

1. Inspect each panel, console, and cabinet to verify compliance with the Contract Documents, approved Shop Drawings, and other approved Contractor submittals.

2. Inspection shall include, but not be limited to, the following:

a. Nameplates and tags.
b. Wire sizes and color coding.
c. Terminal block contact ratings and numbers.
d. Panel-mounted equipment and identification.
e. External and internal panel layout.
f. Proper wiring practices and grounding.
g. Enclosure flatness, finish and color.
h. NEMA rating and environmental control equipment.

3. Correct materials and equipment that do not comply with the Contract Documents and submittals approved by the Engineer, and re-inspect until compliance is verified.

B. Factory Tests

1. System Hardware Operational Testing:

a. Test each input/output device and component to verify operability. If panel or device being tested contains pneumatic systems, test the instruments associated with such systems to verify that calibration.

b. Test all system hardware components to verify proper operation of the equipment as stand-alone units and as a system. Tests shall include, but are not necessarily limited to, the following:

(1) AC/DC power checks.
(2) Power fail/restart tests.

(3) Verify that network switch, and fiber-optic converters are powered by separate circuits.

(4) Verify that the quantity of circuits assigned to power field instruments corresponds to approved Shop Drawings and other approved Contractor submittals.

c. Criteria for Acceptance: System hardware operational testingshall acceptably demonstrate that specified and required equipment operations capabilities function properly.

d. Test remote I/O, operator interface terminals, linking devices, and similar devices, to verify that communication between units functions properly.

e. Perform an integrated system test, with all control system equipment connected (excluding field sensors and instruments), to verify that equipment performs and functions properly as an integrated system. During the factory test, simulate field sensors and instruments using appropriate signal generators, switches, and jumper cables.

f. Separately test each panel furnished under this Contract to verify that panel instruments and processors are perform and function properly in accordance with the Contract Documents. For the factory test required in this Section, simulate field sensors and field instruments using appropriate signal generators, switches, and jumper cables.

2. System Hardware Demonstration:

a. PICS shall perform and be solely responsible for system hardware demonstration of their systems factory test.

b. Preparation:

(1) System performance shall be tested using fully-integrated system, including all software and hardware. Entire control system, including one of each type of field device with interconnecting cables, shall be assembled at the factory test location and simulated inputs applied. Signal generators shall be appropriately sized and calibrated for full range of use and shall have a power source to accommodate not less than a full day of testing. Prior to the

factory test, provide process I/O simulation panel that includes the following:

(a) Toggle switches to simulate field or other input contacts.
(b) Indicating lights to simulate outputs from tested panels.
(c) Control relays to simulate motor control center coil inputs.
(d) Time relays to simulate position switches.
(e) Indications (in milliamps) to indicate every 4 to 20 ma-dc output from tested panel.
(f) Potentiometers to simulate 4 to 20 ma-dc inputs to tested panel.
(g) Each device shall have nameplate with description and device's process and instrumentation Drawings (P&ID) tag number. Nameplates shall be removable and interchangeable for multiple use of the panel during the test.

(2) Operator Interfaces: Prior to factory testing of the system, configure the display environments in accordance with the display structure agreed upon between the PICS Supplier, Engineer, and Owner. Load and link database parameters to the specified fields.

c. Factory Test:

(1) PICS shall demonstrate system software utility programs and system software security programs incorporated into their control system, to demonstrate proper functioning of the various functions and capabilities specified.

(2) Perform complete system test, during which entire system shall operate continuously without failure in accordance with the Contract Documents.

(3) Demonstrate the monitoring and control information displayed on each HMI screen, based on simulation of each associated point for each screen, in accordance with test procedure approved by the Engineer. Simulation through forced values in the PLC programming is acceptable. In addition, the Owner or Engineer will randomly select, at the time of the factory test, additional inputs and outputs to

be simulated in quantity not less than 5% of total I/O quantity. Demonstrate that monitoring and control application software associated with I/O points performs and functions as intended.

(4) Demonstrate communications between integrated system elements; include such demonstration in the testing procedure submittal, where applicable.

(5) Operator Interfaces:

(a) During factory test, demonstrate overall display structure, including environment configurations, passwords, security, and other parameters and functions.
(b) Review menu display contents to demonstrate how an operations personwill navigate within the overall display structure.
(c) Demonstrate assignment of displays to annunciator keys.
(d) Review each graphic display for correctness relative to layout, symbols, color scheme, and other requirements.
(e) Demonstrate operation of standard alarm management displays (current alarm display, alarm history, and similar alarm displays).
(f) Perform demonstration of each type of report specified. Printing shall be an integral part of the report demonstration.
(g) Perform testing of new graphics developed for the existing SCADA software.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 13600
PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. This Section covers the furnishing and installation of an instrumentation and control system. The system shall be furnished as specified, complete with all software, hardware, input/output hardware, instrumentation, and all devices, accessories, appurtenances, testing, system commissioning, and training necessary for proper operation. All other process instrumentation and control systems shall be furnished under this Section by a single Process Instrumentation Control System (PICS) Supplier herein called the "PICS Supplier".

2. The PICS Supplier shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete process instrumentation control system.

3. The process instrumentation and control Work includes, but is not limited to, the following:

   a. Panels and panel-mounted instruments and devices.
   b. Field-mounted instruments and devices.
   c. Programmable logic controllers (PLC) and software.
   d. Human-machine interface (HMI) software and configuration.
   e. Local area network hardware and software.
   f. Uninterruptible power supply.
   g. Field instruments hardware and software required for interfacing various systems to provide a fully-integrated system.
   h. Programming and configuring of control panels and SCADA software including remote dial out.
   i. Historical Database, trending, report generation

B. PICS shall monitor, store, display, and log process and equipment operating information; perform various process control functions; and generate various reports.

C. The Contract Documents describe the required PICS and PICS functions and operational requirements.

D. All software shall be of the latest releases.

E. Coordination

1. Process Controls:

a. The PICS Supplier shall be required to attend monthly coordination meetings upon receiving the notice to proceed and once the PICS Supplier is on site, coordination meetings will be required every 2 weeks.

b. A central computer system is proposed and is provided this contract, the software is VT SCADA. Instruments, PLC's/ PLC's and controls programming (I&C) Work under this contract provided by PICS Supplier shall, as part of the scope, be interfaced with existing computer system. Programming of control logic and configuration of the control system with new process graphical screens - human machine interface (HMI) software is part of the Work. Process control description of process system and its associated equipment is included in Section 13030, Software Control Block Descriptions.

c. Some panels and equipment provided by others but furnished under other Specification Sections are under this Contract for coordination and integration into the total control system. The Contractor is responsible for any additional hardware and software that is needed to interface with these panels.

d. The Contractor shall coordinate with Suppliers of panels and equipment to provide fully functional system complying with the Contract Documents and that interfaces with the central computer system.

e. Computer system input/output list identifies the inputs and outputs that is required, and is part of this Section. Use the input/output list for coordinating signals between equipment provided under this and other contracts, but may not be totally inclusive, verification is the responsibility of the PICS. Include Work for other vendor supplied furnished control options not on the input/output list at no additional cost to the Owner.

2. PICS Supplier's Responsibilities:

a. Preparing all process control equipment submittals in accordance with the Contract Documents.

b. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged process control systems furnished by other equipment suppliers, and any required interfacing with the Site's electrical system such as generator or power monitoring.
c. Review and coordination with manufacturers, other suppliers, and other contracts of Shop Drawings and other Contractor submittals for equipment, valves, piping, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
d. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections.
e. Calibrating, source quality control, field quality control, and start-up of the system.
f. Responsibility for correction period obligations for the PICS.
g. Training operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the PICS.

1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.
2. ISA 5.4, Instrument Loop Diagrams.
3. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
4. NFPA 79, Electrical Standard for Industrial Machinery.

1.03 QUALITY ASSURANCE

A. Qualifications

1. Supplier:

a. Shall be financially sound with at least ten years of continuous experience in designing, implementing, supplying, and supporting process control systems for municipal water treatment facilities comparable to PICS required for the Project, relative to hardware, software, cost, and complexity.

b. Shall have record of at least 10 successful process control system equipment installations in the past year. Upon the Engineer's request, submit record of experience for at least eight projects, each with the following information: project name, owner name and contact information, name and contact information for contractor, name and contact information for engineer or architect, and approximate and contract value of process control systems Work for which Supplier was responsible,

c. Shall be capable of training operations and maintenance personnel in PICS applications, and in operating, programming, and maintaining the control system and equipment.

d. Shall have UL-approved panel shop.

e. Supply and support system hardware components and software packages of fully developed and field-proven standardized designs that are not a highly unique, custom, or one-of-a-kind systems.

f. Possess a thorough, working knowledge of water treatment processes and control philosophy in accordance with standard practices of the water treatment industry.

g. Possess and maintain a documented program of failure analysis.

h. The PICS Supplier shall be:

(1) Rocha Controls.
(2) Revere Controls.
(3) Commerce Controls.

B. Manufacturers

1. Manufacturers of instrumentation and control equipment furnished for the PICS shall be experienced producing similar equipment and shall have the following qualifications:

a. Shall manufacture instrumentation and control system components that are fully-developed, field-proven, and of standardized designs.
b. Shall have system of traceability of manufactured unit through production and testing in accordance with ANSI/ASQ Z1.4.
c. Shall have guaranteed availability clause (99.99% minimum for 3 years) for microprocessor-based components and appurtenances.

d. Shall have documented product safety policy relevant to materials and equipment proposed for the Work.

C. Pre-submittal Conference

1. Schedule and conduct a pre-submittal conference by the PICS Supplier within 45 days after acceptance of the PICS Supplier by the Owner.

2. Required Attendance for Pre-submittal Conference: The Contractor, PICS Supplier, Engineer, and Owner. Pre-submittal conference will be approximately 8 hours. The conference will be held at the Engineer's office unless otherwise acceptable to the entities attending.

3. Purpose of pre-submittal conference is to review manner in which PICS Supplier intend to comply with requirements of the Contract Documents relative to PICS submittals before submittals are prepared.

4. Bring to pre-submittal conference list of proposed personnel committed to assignment to the Project. The list shall include the PICS Supplier project manager, project engineer, any field representatives or local service representative, and sales representative(s); and similar personnel for the PICS Supplier. Indicate addresses of personnel not based at Subcontractor's and Supplier's office nearest to the Site.

5. Prepare items listed below for presentation at pre-submittal conference. Submit information to the Engineer 2 weeks prior to the pre-submittal conference.

   a. List of materials and equipment required for PICS, and manufacturer and model proposed for each item.
   b. List of currently-known requests for interpretations of which the Contractor and PICS Supplier are aware.
   c. List of proposed exceptions to the Contract Documents along with brief explanation of each.
   d. Proposed PICS network architecture diagram.
   e. Sample of each type of process control submittal required by the Contract Documents. These may be submittals prepared for other projects.
   f. Flow chart showing steps to be taken in preparing and coordinating PICS submittals.
   g. General outline of types of tests to be performed to verify that all sensors and transducers, instruments, and digital processing equipment are functioning properly.

1.04 SUBMITTALS

A. Action Submittals: Submit the following in accordance with Division 1, General Requirements:

1. Shop Drawings:

a. Field Instruments:

(1) Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
(2) Instrument tag number in accordance with the Contract Documents.
(3) Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
(4) Description of construction features.
(5) Performance and operation data.
(6) Installation, mounting, and calibration details; instructions and recommendations.
(7) Service requirements.
(8) Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.
(9) Range of each device and calibration information.
(10) Descriptions of materials of construction and listing of NEMA ratings for equipment.

b. Panels, Consoles, and Cabinets:

(1) Layout drawings that include:

(a) Front, rear, and internal panel views to scale.
(b) Tag number and functional name of components mounted in and on panel, console, or cabinet, as applicable.
(c) Product information on panel components.
(d) Nameplate location and legend including text, letter size and colors to be used.
(e) Location of anchorage connections.

(f) Location of external wiring and piping connections.
(g) Mounting and installation details, coordinated with actual application.
(h) Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.
(i) Calculations substantiating panel heating and cooling provisions proposed.
(j) Subpanel layouts and mounting details for items located inside control panels.

(2) Product information on panel components including:

(a) Manufacturer's product name and complete model number of devices being provided, including manufacturer's name and address.
(b) Instrument tag number in accordance with the Contract Documents.
(c) Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20.
(d) Description of construction features.
(e) Performance and operation data.
(f) Installation, mounting, and calibration details; instructions and recommendations.
(g) Service requirements.

(3) Wiring and piping diagrams, including the following:

(a) Name of each panel, console, or cabinet.
(b) Wire sizes and types.
(c) Pipe sizes and types.
(d) Terminal strip and terminal numbers.
(e) Wire color coding.
(f) Functional name and manufacturer's designation for components to which wiring and piping are connected.
(g) Lightning and surge protection grounding.

(4) Electrical control schematics in accordance with NFPA 79. Control schematics shall be in accordance with convention indicated in Annex D of NFPA 79. Standardized wiring

diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.

(5) Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.

(6) Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.

c. Field wiring and piping diagrams, include the following:

(1) Wire and pipe sizes and types.
(2) Terminal numbers at field devices and in panels.
(3) Fiber optic termination designations in the field and in panels.
(4) Color coding.
(5) Conduit numbers in which wiring will be located.
(6) Locations, functional names, and manufacturer's designations of items to which wiring or piping are connected.

d. Proposed operator interface graphics layouts. Each graphic display and process report layout will be subject to modification from the Contractor's submitted format within limits of software package used for development. Implement such modifications in accordance with the Engineer's written comments on the submittal.

e. Plant monitoring and control system (PMCS):

(1) Submit the following general information:

(a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
(b) Software listings for operating system, applications, and HMI.
(c) Software language and organization.
(d) Format, protocol and procedures for data transmission and communications with input/output modules and peripheral devices, including wide

area network (WAN) or local area network (LAN) devices.

(e) HMI interfacing details, licensing structure, and included functions.

(f) Control and failure modes.

f. Online and offline capabilities for programming, system utilities, and diagnostics.

g. Input/Output Information:

(1) Input/output (I/O) point listing with I/O module cross-reference identification.

(2) I/O module cross-reference identification based on I/O address list developed by PICS Supplier.

h. Database listing, including all I/O points.

i. Suggested detailed format and configuration of log reports, alarm summaries, printer outputs, displays, and graphics.

2. Hardware:

a. Layout drawings showing front, rear, end, and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.

b. Equipment ventilation and cooling requirements.

c. Interconnection diagrams, including termination details, cable identification list, and cable length.

d. Drawings showing equipment layout.

e. Installation requirements, instructions, and recommendations.

3. Software:

a. Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.

b. Provide information of number of run, client, and development licenses as well as I/O point count limit per license.

c. Standard technical and instructional documentation covering software for utility, system support, system documentation,

display, communications, data logging and storage and diagnostic functions. Submit this information as electronic files.

d. Standard technical documentation covering all aspects of the computer system software functions and capabilities, including instruction set description and programming procedures related to monitoring, display, logging, reporting and alarming functions.

e. Detailed functional descriptions of application programs explaining control, display, logging and alarming features to be provided and functions to be performed.

4. Documentation describing memory type, size and structure and listing size of system memory, I/O and data table memory and size of memory available for control programs.

5. System I/O Loop Wiring Diagrams: Prepare Shop Drawings on module-by-module basis and include the following information:

   a. Rack numbers, module type and slot number, and module terminal point numbers. Include location and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.

   b. Wiring types, wire numbers, and color coding.

   c. Designation of conduits in which field I/O wiring will be installed.

   d. Location, functional name, tag numbers and manufacturer's module numbers of panel and field devices and instruments to which I/O wiring will be connected.

   e. Prepare loop wiring diagrams in accordance with ISA 5.4.

   f. Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:

      (1) Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions. The Contractor is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.

(2) Numbered terminal block and terminal identification for each wire termination.
(3) Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
(4) Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
(5) Junction and pull boxes through which wiring will be routed.
(6) Identification of equipment in accordance with the Contract Documents.

6. Product Data:

a. Product data for field instruments in accordance with requirements for Shop Drawings in this Section.
b. Product data for panels, consoles, and cabinets in accordance with requirements for Shop Drawings in this Section.
c. Product data for field wiring and piping provided for instrumentation and control service and not included under other sections or contracts.
d. Product data for SCADA system, including software and hardware. Requirements for software product data are included in requirements for Shop Drawings under this Section.

7. Samples:

a. Color charts for finish paint for metallic panels. Provide full range of paint manufacturer's standard and custom colors. Color selection will be by the Engineer.
b. Color charts for fiberglass-reinforced panels. Provide full range of panel manufacturer's standard and custom colors. Color selection will be by the Engineer.

8. Factory Acceptance Test Procedure: Submit proposed procedures for factory testing required to comply with the Contract Documents. Test procedure shall include the following:

a. Visual inspection of components and assembly.
b. Description of hardware operational testing.
c. Description of software demonstration.
d. Description of testing equipment to be used.
e. Sign-off sheets to be used at time of testing.

B. Informational Submittals: Submit the following:

1. Documents to be submitted prior to pre-submittal conference, in accordance with this specification.

2. System Software Documentation: Submit preliminary software documentation not later than 28 days prior to scheduled start of factory testing. Software documentation shall include the following:

3. Complete printed copies of all programming.

   a. Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.
   b. Copies of all configured HMI screens.

4. Manufacturer's Instructions:

   a. Shipping, handling, storage, installation, and start-up instructions.
   b. Templates for anchorage devices for materials and equipment that will be anchored to concrete or masonry.

5. Source Quality Control Submittals:

   a. Results of factory testing.

6. Special Procedure Submittals:

   a. Notification to the Owner and Engineer at least 14 days before readiness to begin system checkout at the Site. Schedule system checkout on dates acceptable to the Owner and Engineer.
   b. Written procedure for system checkout. Submit not less than 90 days prior to starting system checkout.
   c. Ninety days prior to starting system checkout submit written procedure for start-up.

7. Field Quality Control Submittals:

    a. Submit the following prior to commencing system checkout and start-up.

        (1) Completed calibration sheets for each installed instrument showing five-point calibration (0, 25, 50, 75, 100% of span), signed by factory-authorized serviceman.
        (2) Field calibration reports.
        (3) Field testing reports.

8. Supplier's Reports:

    a. Installation inspection and check-out report.
    b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within 2 days of completion of visit to the Site.

9. Qualifications Statements:

    a. PICS Supplier.
    b. Manufacturers, when required by the Engineer.

C. Closeout Submittals: Submit the following:

1. Operations and Maintenance Data:

    a. Submit in accordance with Section 01830, Operations and Maintenance Manuals.
    b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.

2. Record Documentation:

    a. Prepare and submit record documents in accordance with, Project Record Documents.

    b. Revise all PICS Shop Drawings to reflect as-built conditions in accordance with the following.

        (1) Use" as-built" updates of approved Shop Drawings and submittals in operation and maintenance manuals.

(2) Half-size black line prints of wiring diagrams applicable to each control panel shall be laminated and placed in envelope inside a suitable print pocket or container inside each control panel.
(3) Submit drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.

D. Maintenance Materials Submittals: Submit the following:

1. Spare Parts and Test Equipment:

a. General:

(1) Furnish the spare parts and test equipment in accordance with the Contract Documents, identical to and interchangeable with similar materials and equipment provided for the PICS under the Contract.
(2) Provide source quality control for spare parts as part of factory testing prior to shipment of process control system equipment.
(3) For process sensors and other analog instruments, the Supplier shall submit a separate quotation for recommended list of spare parts and test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of 2 years from date of equipment installation and that the Supplier understands that the Owner reserves the right to purchase none, any, or all parts quoted. Upon request, the Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of the Owner's order.

b. Furnish the following spare parts per PLC supplied:

(1) Five of each type of input/output relay for each quantity of 25 or fraction thereof provided under the Contract.
(2) One complete PLC, including One type of each PLC input/output module or card used.
(3) One replacement power supply for each type and size provided under the Contract.
(4) One-year supply of all expendable or consumable materials.

(5) One per quantity of five or fraction thereof of gauges, indicators, and switches provided, complete with diaphragm seals, filled and ready to use.
(6) Twelve of each type and size of fuse used in instruments.

2. Software:

a. Furnish copies of all software (with the selected versions) licensed to Columbia County. Follow the submittal guidelines for software submittals.
b. Submit copies of programming and configuration files developed specifically for the Project in accordance with Operations and Maintenance Data.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prior to packaging, each manufacturer or supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument. Refer to Division 1, General Requirements.

PART 2 PRODUCTS

2.01 PICS – GENERAL PROVISIONS FOR PRODUCTS

A. General:

1. All electrically-powered equipment and devices shall be suitable for operation on 115-volt plus-or-minus 10%, 60-Hertz plus-or-minus 2-Hertz power. If different voltage or closer regulation is required, provide suitable regulator or transformer.

2. Provide appropriate power supplies for all two-wire transmitters, loops for monitoring discrete inputs and necessary outputs. Install power supplies mounted in enclosures, and install in appropriate control room or field panel.

3. Power supplies shall be suitable for minimum of 130% of the maximum simultaneous current draw.

4. Provide power on-off switch or air circuit breaker for each item requiring electrical power.

5. Provide isolation transformers, line voltage regulators and power distribution panels for the distributed digital portions of the PICS to

eliminate electrical noise and/or transients entering on the primary power line.

6. Unless otherwise shown or indicated in the Contract Documents, control system shall be furnished to use 4 to 20 mA DC analog signals.

7. Provide signal converters and repeaters where required. Analog inputs to distributed control system shall be through appropriate repeaters to provide signal isolation where series-looped with other devices and to allow loop to maintain integrity even when distributed control system is out of service. Power supplies shall be adequate for signal converter and repeater loads.

8. Signals shall be isolated from ground.

9. Signals shall not have a transient DC voltage exceeding 300 volts over 1 millisecond nor a DC component over 300 volts.

10. PICS and associated input/output wiring will be used in a facility environment where there can be high-energy AC fields, DC control pulses, and varying ground potentials between the sensors/transducers or input contact locations and PICS components. PICS shall be adequate to provide proper protection against interferences from all such possible situations.

11. Instrumentation and PICS components shall be heavy-duty types, suitable for continuous service in a municipal water treatment plant environment. Furnish products that are currently in production at the time products are shipped from the factory. All equipment furnished shall be of modular construction and be capable of field expansion through installation of plug-in circuit cards and additional cabinets as necessary. Logic and control loops shall be fail-safe.

12. Instrumentation and other PICS components shall return automatically to accurate measurement within 15 seconds upon restoration of power after a power failure, and when transferred to standby power supply.

13. Provide surge protection for instruments and all other PICS components that could be damaged by electrical surges.

14. Field-mounted instruments and PICS components shall be suitable for installation in humid and corrosive service conditions. Field-mounted

instrument enclosures, junction boxes, and appurtenances shall comply with NEMA 4X requirements:

a. FRP in Chemical Containment Areas.
b. 316 SS for all other.
c. Refer to drawings for additional requirements.

15. Relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are unacceptable.

16. Panel mounted instruments, switches, and other devices shall be selected and arranged to present a pleasing coordinated appearance. Front-of-panel-mounted devices shall be of the same manufacturer and model line.

17. All components furnished, including field-mounted and rear-of-panel instruments, shall be tagged with the item number and nomenclature as shown and the instrument index in the Contract Documents or, as applicable, the "data sheets" that are part of the Contract Documents.

18. Ranges and scales specified in the Contract Documents shall be coordinated to suit equipment actually furnished. Range, scale, and set point values specified in other sections are for initial setting and configuration. Coordinate specified values with actual equipment furnished to implement proper and stable process action as systems are placed in operation.

19. Field-mounted devices shall be treated with an anti-fungus spray.

20. Field-mounted devices shall be protected from exposure to freezing temperatures.

B. Environmental Conditions:

1. PICS and its components shall be designed and constructed for continuous operation under the following temperature and humidity conditions:

a. Equipment and Devices Installed in Control Rooms:

(1) Ambient Temperature: 60 degrees F to 80 degrees F normal range; and 40 degrees F to 105 degrees F occasional maximum extremes.
(2) Relative Humidity: 80% normal; 95% maximum.

b. Equipment and devices installed at indoor locations (other than control rooms) for digital processing equipment hardware, control panels, and instruments:

(1) Ambient Temperature: 40 degrees F to 120 degrees F.
(2) Relative Humidity: 98% maximum.

c. Equipment and Devices Installed Outdoors:

(1) Ambient Temperature: -10 degrees F to 120 degrees F.
(2) Relative Humidity: 100% maximum.

PART 3 EXECUTION

3.01 PICS – GENERAL PROVISIONS FOR EXECUTION

A. Refer to the following sections for execution requirements for the PICS:

1. Section 13030, Software Control Block Descriptions.
2. Section 13060, Fiber Optic Cabling.
3. Section 13070, Panel Mounted Instruments and Devices.
4. Section 13080, Primary Sensors and Field Instruments.
5. Section 13090, Process Control Panels and Hardware.
6. Section 13150, Programmable Logic Controllers.
7. Section 13200, Process Control System Input/Output List.
8. Section 13300, Plant Monitoring and Control System Training.
9. Section 13400, Process Control System Start-Up and Field Testing.
10. Section 13500, Process Control System Factory Testing.
11. Section 13600, Process Control System General Provisions.

END OF SECTION

SECTION 13615
PARSHALL FLUME

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, and incidentals required to provide the fabrication and installation of a Parshall flume as shown on the Drawings and specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D256—Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
2. ASTM D570—Standard Test Method for Water Absorption of Plastics.
3. ASTM D635—Standard Test Method for Rate of Burning and Extent and Time of Burning of Plastics in a Horizontal Position.
4. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
5. ASTM D696—Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics between -30°C and 30°C With a Vitreous Silica Dilatometer.
6. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Material.
7. ASTM D1494—Standard Test Method for Diffuse Light Transmission Factor of Reinforced Plastics Panels.
8. ASTM D2583—Standard Test Method for Indention Hardness of Rigid Plastics by Means of a Barcol Impresser.
9. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.

B. The Parshall flume shall have accurate internal dimensions conforming to those shown in the US Department of Agriculture, Soil Conservation Service, Circular 843.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

B. All work, equipment, and materials furnished and installed shall be warranted against defective design, materials, and workmanship for a minimum of 1 year. The warranty period shall begin at the date of substantial completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. Service Conditions: The Parshall flume is located outdoors, shall be submerged in treated municipal wastewater effluent, and is subject to exposure of sodium hypochlorite 5 to 30 mg/L as chlorine.

B. The Parshall flume shall be constructed of corrosion-resistant fiberglass-reinforced polyester resin laminate with a minimum glass content of 30% by weight and resin rich white surface layer suitable for the specified service

conditions. The fiberglass-reinforced polyester resin laminate shall include a UV inhibitor. The Parshall flume wall and bottom thickness shall be 1/4 inch minimum.

C. The Parshall flume shall be reinforced with box section stiffeners down the sides and across the bottom. The stiffeners shall be joined together at the knee to form a rigid dimensionally stable flume. The inside surfaces of the Parshall flume shall be smooth and free of irregularities or blemishes. The flume shall be free standing, holding all dimensions without distortion, with a full head of wastewater effluent flowing through it.

D. The Parshall flume shall be provided with sufficient flanges, reinforcing ribs, and/or anchor ribs to prevent distortion during shipment, installation, and operation as well as providing for permanent anchorage in the concrete channels. The flume shall be furnished with fiberglass tie strips or aluminum tie rods across the top of the flume to retain the side walls vertical during concrete placement.

2.02 DETAILED SPECIFICATION

A. The flume shall perform in accordance with the requirements of the *Water Measurement Manual*, as published by the US Department of the Interior Bureau of Reclamation, specifically the performance requirements listed in Table A8-12, *Free-flow discharges in ft^3/sec through 1- to 8-foot Parshall flume*.

B. The flume shall have a throat dimension of 12 inches, as a minimum, and accurately measure the treated effluent flow over a range from 0.1 to 2.5 feet of head. The resulting range of flow is 54 to 7,240 gpm.

2.03 ACCESSORIES

A. All Parshall flume accessories specified in this Section shall be furnished by the flume manufacturer.

B. The Parshall flume shall be provided with one appropriately located head gauge, integrally molded into the converging throat section sidewalls. The gauge shall span the full sidewall depth and be graduated in tenths and hundredths of a foot. A separate 8-1/2- by-11-inch plastic-laminated card shall be provided with the flume head gauge. The card shall have a curve calibrated to permit direct conversion of flow depth at the head gauge to wastewater flow in million gallons per day over the measurable flow range for the flume. The curve shall be completely waterproof and suitable for filing in a three-ring binder.

C. The Parshall flume shall be provided with an adjustable T-304 stainless steel support bracket to mount an ultrasonic flow transducer over the waterway as specified in Division 13, Special Construction.

D. A 16-gauge stainless steel equipment identification plate shall be provided and securely mounted to the Parshall flume in a readily visible location. The plate shall bear the 1/4-inch die-stamped equipment identification number assigned to the flume specified in this Section and as shown on the Drawings.

E. The Parshall flume shall be provided with lifting lugs if it weighs over 100 pounds.

F. The Parshall flume shall be provided with inlet and/or outlet bulkheads or wingwalls to transition flow between the flume and channel.

2.04 PARSHALL FLUME MANUFACTURER

A. Plasti-Fab, Inc.
B. Or Engineer-approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the Parshall flume in accordance with the Contract Documents and the manufacturer's written instructions.

B. Firmly secure the flume to the flume channel and set and level the flume to the inlet invert elevation shown on the Drawings before placing any concrete fill. With the flume secured in place, fill under and along the sides of the flume to a maximum height of the flume invert with concrete fill. Allow the fill to set for 24 hours before additional fill placement. After the initial concrete lift has set, continue filling the annular space between the flume and concrete channel using 6-inch maximum concrete lifts. Concrete fill shall be as specified in Division 3, Concrete. Care shall be taken to avoid distortion of the flume dimensions or air entrapment under, and flotation of, the flume during fill placement. The flume shall be permanently set level and according to the elevations shown on the Drawings; the flume invert shall be set to the nearest 0.01 foot using an engineering level.

3.02 PAINTING AND SURFACE PREPARATION

A. Not required for UV-protected laminate.

3.03 FIELD TESTING

A. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

3.04 CLEANING AND PROTECTION

A. Replace all Parshall flume components damaged during flume delivery and installation at no expense to the Owner.

3.05 TRAINING SERVICES

A. Training services shall be in accordance with Section 11000, General Equipment Requirements.

3.06 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a manufacturer's Certification of Compliance for the equipment specified in this Section.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Welding certificates.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM B32—Standard Specification for Solder Metal.
2. ASTM B813—Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
3. ASTM B828—Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

4. ASTM C1173—Standard Specification for Flexible Transition Couplings for Underground Piping Systems.
5. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
6. ASTM D2235—Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
7. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2657—Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
9. ASTM D2661—Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.
10. ASTM D2672—Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
11. ASTM D2846/D3846M—Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
12. ASTM D2855—Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
13. ASTM D3138—Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components.
14. ASTM D3139—Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
15. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
16. ASTM F402—Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
17. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
18. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

B. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose, Inch.
2. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.
3. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
4. ASME B31—Code for Pressure Piping.
5. ASME BPVC—Boiler and Pressure Vessel Code.

C. American Water Works Association (AWWA)

1. AWWA C110/A21.10—Standard for Ductile-Iron and Gray-Iron Fittings.
2. AWWA C219—Bolted, Sleeve-Type Couplings for Plain-End Pipe.

D. American Welding Society (AWS)

1. AWS A5.8/A5.8M—Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1/D101M—Structural Welding Code – Steel.
3. AWS D10.12—Recommended Practices and Procedures for Welding Low Carbon Steel Pipe.

A. Manufacturers Standard Society (MSS)

1. MSS SP-107—Transition Union Fittings for Joining Metal and Plastic Products.

1.04 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, Structural Welding Code – Steel.

B. Steel Pipe Welding: Qualify processes and operators according to ASME BPVC: Section IX, Welding and Brazing Qualifications.

1. Comply with provisions in ASME B31 Series, Code for Pressure Piping.
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing by the Engineer and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material before, during, and after installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During the installation, piping, ductwork, and similar openings shall be capped to keep out dirt and other foreign matter.

C. The Contractor shall store plastic pipes protected from direct sunlight and supported to prevent sagging and bending.

1.06 COORDINATION

The Contractor shall do the following:

A. Arrange for pipe spaces, chases, slots, and openings in building structure during construction to allow for mechanical installations.

B. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.

D. Provide coordination drawings at 1/4 inch = 1 foot, 0 inch scale illustrating the coordination of piping, ductwork, lighting, and structure for an interference-free installation. Provide 24-inch-x-36-inch bond paper and submit for review.

1.07 DEFINITIONS

A. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. *Exposed, Interior Installations*: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. *Exposed, Exterior Installations*: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. *Concealed, Interior Installations*: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. *Concealed, Exterior Installations*: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where paragraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 Piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: Refer to ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

Joining materials shall be as follows:

A. Refer to individual Division 15 Piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents:

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated:

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110/A21.10, rubber, flat face, 1/8-inch thick, unless otherwise indicated, and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

F. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated, and AWS A5.8/A5.8M, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D2235.
2. CPVC Piping: ASTM F493.
3. PVC Piping: ASTM D2564. Include primer according to ASTM F656.
4. PVC to ABS Piping Transition: ASTM D3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by the pipe manufacturer.

2.04 TRANSITION FITTINGS

Transition fittings shall be as follows:

A. AWWA Transition Couplings: The same size as and with pressure rating at least equal to and with ends compatible with the piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions, one end with threaded brass insert and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions, one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Available Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C1173 with elastomeric sleeve, ends the same size as the piping to be joined, and a corrosion-resistant metal band on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.05 DIELECTRIC FITTINGS

Dielectric fittings shall be as follows:

A. Description: A combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig (1,725 kPa) minimum working pressure at 180° F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig (1,035 or 2,070 kPa) minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150 or 300 psig (1,035 or 2,070 kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, threaded ends, and 300 psig (2,070 kPa) minimum working pressure at 225° F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive thermoplastic lining; plain, threaded, or grooved ends; and 300 psig (2,070 kPa) minimum working pressure at 225°F.

1. Available Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

PART 3 EXECUTION

3.01 PIPING SYSTEMS – COMMON REQUIREMENTS

A. The Contractor shall install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. The Drawings, schematics, and diagrams indicate the general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install the piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow the application of insulation.

K. Select system components with a pressure rating equal to or greater than the system operating pressure.

L. Sleeves are not required for core-drilled holes.

M. Permanent sleeves are not required for holes formed by removable PE sleeves.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream the ends of pipes and tubes and remove burrs. Bevel the plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from the inside and outside of the pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to the tube end. Construct joints according to ASTM B828 or CDA's *Copper Tube Handbook* using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's *Brazing Handbook*, "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" article.

H. Flanged Joints: Select the appropriate gasket material, size, type, and thickness for service application. Install the gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 Appendixes.
3. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
5. PVC Nonpressure Piping: Join according to ASTM D2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657:

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass-Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to the pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions in piping NPS 2 (DN 50) and smaller adjacent to each valve and at the final connection to each piece of equipment.
2. Install flanges in piping NPS 2-1/2 (DN 65) and larger next to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install equipment to allow the maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow the right of way for piping installed at the required slope.

3.05 PAINTING

A. The painting of mechanical systems, equipment, and components is specified in Section 09900, Painting and Coating.

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match the original factory finish.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor the equipment to the concrete base according to the equipment manufacturer's written instructions.

1. Construct concrete bases of the dimensions indicated, but not less than 4 inches larger in both directions than the supported unit.
2. Install dowel rods to connect the concrete base to the concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through the concrete base and anchor into the structural concrete floor.
4. Place and secure anchorage devices. Use the supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with the items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to the supported equipment.
6. Install anchor bolts according to the anchor-bolt manufacturer's written instructions.

7. Use compressive-strength concrete and reinforcement as specified in Section 03300, Cast-In-Place Concrete.

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 05500, Metal Fabrications.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.08 GROUTING

The Contractor shall do the following:

A. Mix and install grout for the mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for the placement of grout.

D. Avoid air entrapment during the placement of grout.

E. Place grout so as to completely fill the equipment bases.

F. Place grout on the concrete bases and provide smooth bearing surface for the equipment.

G. Place the grout around the anchors.

H. Cure placed grout.

END OF SECTION

SECTION 15053
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Concrete bases.
9. Supports and anchorages.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Welding certificates.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.

B. American Society for Testing of Materials (ASTM)

1. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

2. ASTM B32—Standard Specification for Solder Metal.
3. ASTM B813—Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
4. ASTM B828—Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
5. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
6. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2672—Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement.
9. ASTM D2846/D2846M—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
10. ASTM D2855—Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
11. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
12. ASTM F402—Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
13. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
14. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

C. American Welding Society (AWS)

1. AWS A5.8M/A5.8—Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1/D1.1M—Structural Welding Code – Steel.
3. AWS D10.12M/D10.12—Guide for Welding Mild Steel Pipe.

1.04 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M.

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.05 DEFINITIONS

A. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. *Exposed, Interior Installations*: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. *Exposed, Exterior Installations*: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. *Concealed, Interior Installations*: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. *Concealed, Exterior Installations*: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

PART 2 PRODUCTS

2.01 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.02 JOINING MATERIALS

A. Refer to individual Division 15 piping sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, unless thickness or specific material is indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series or Bag1, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12M/D10.12.

G. Solvent Cements for Joining Plastic Piping:

1. CPVC Piping: ASTM F493.
2. PVC Piping: ASTM D2564. Include primer according to ASTM F656.

2.03 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.04 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

D. PVC Pipe: ASTM D1785, Schedule 40.

2.05 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.06 GROUT

A. Description: ASTM C1107/C1107M, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5,000 psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 PIPING SYSTEMS – COMMENT REQUIREMENTS

A. Install piping according to the following requirements and Division 15 sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inchannular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floor at pipe penetrations. Seal pipe penetrations with firestop materials.

O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's *Copper Tube Handbook* using lead-free solder alloy complying with ASTM B32.

E. Brazed Joints: Construct joints according to AWS's *Brazing Handbook*, "Pipe and Tube" chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8M/A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to Article 1.044.

H. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402, for safe-handling practice of cleaners, primers, and solvent cements.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
3. PVC Pressure Piping: Join schedule number ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.
4. PVC Nonpressure Piping: Join according to ASTM D2855.

I. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D3212.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.05 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 incheslarger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use the supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to the anchor-bolt manufacturer's written instructions.
7. Use 3,000 psi, 28-day compressive-strength concrete and reinforcement as specified in Section 03300, Cast-In-Place Concrete.

3.06 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Section 05500, Metal Fabrications, for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.07 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.08 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely fitting equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 15055
PIPING SYSTEMS—GENERAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes responsibilities and requirements for Piping Systems including the following:

1. Labor, materials, tools, equipment, and services to be furnished in accordance with the provisions of the Contract Documents. The materials to be used for the piping systems shown in the Drawings are listed by service in the Piping Schedule, included in the Contract Drawings.
2. Coordination of work with other trades.
3. Furnishing and installing all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, although such work is not specifically indicated.
4. Furnishing Record Drawings and documents for piping systems.

1.02 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

A. If the Contractor deviates from the piping layout as shown on the Contract Drawings, the Contractor shall submit scaled piping drawings showing locations and dimensions to and from fittings, valves, tanks, equipment, structures, and related appurtenances. Provide scaled drawings to a minimum scale of 1 inch equals 10 feet. Provide details to minimum scale of 1/8 inch equals 1 foot. Elevations shall correspond to reference vertical elevation datum shown or provided for this project.

B. Copies of any manufacturer's written directions regarding material handling, delivery, storage, and installation.

C. Record piping drawings shall meet the requirements of Section 01785, Record Documents. During the work, the Contractor shall maintain accurate, up-to-date Record Drawings of piping systems installed in the project, including pre-existing piping discovered, relocated, or at locations other than as originally shown on the Drawings. When the work is completed and accepted by the Owner and the Engineer, the Contractor shall submit Record Drawings in accordance with Section 01785, Record Documents. The Contractor shall identify complete

location, elevations, and description of piping systems. Piping systems and fittings are to be identified from three points on structures and/or stationary appurtenances.

D. Submit copies of forms documenting required field pressure testing work and results.

E. Submit welding certificate copies.

F. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

G. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

H. Support Systems

1. Drawings of each piping system locating each support, guide, and anchor.
2. Identify support, guide, and anchor type by catalog number and shop/ contract drawing detail number

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME B1.1—Unified Inch Screw Threads (UN and UNR Thread Forms).
2. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
3. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.
4. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts, and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
5. ASME B18.2.2—Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).
6. ASME B31.1—Power Piping.
7. ASME B31.3—Process Piping.
8. ASME BPVC—Boiler and Pressure Vessel Code.

B. American Society for Testing and Materials (ASTM)

1. ASTM A183—Specification for Carbon Steel Track Bolts and Nuts.
2. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
3. ASTM A194/A194M—Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
4. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
5. ASTM D1330—Standard Specification for Rubber Sheet Gaskets.
6. ASTM F467—Standard Specification for Nonferrous Nuts for General Use.

C. American Water Works Association (AWWA)

1. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).

D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

1. MSS SP-58—Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

E. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. The Contractor shall protect the pipe from kinks, cuts, end damage, and other defects when transporting all piping. Binding and tie-down methods shall not damage or deflect the pipes in any way. Pipe damaged during shipment shall be rejected.

C. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects that could damage the pipe. Stacking of any pipe shall be limited to a height that

will not cause excessive deformation of the lower layers of pipe under anticipated temperature conditions. When necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to not allow deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or sub-grade work is complete and ready to receive the pipe.

D. The joined pipe shall be handled in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped. Slings for handling joined pipe shall not be positioned at socket-welded joints. Sections of the pipes with cuts and gouges shall be removed and the ends of the pipe rejoined. In accordance with the pipe manufacturer's written instructions, the Contractor shall repair all pipe with damaged linings and pipe exterior coatings that have been damaged before the pipe is installed.

E. The Contractor shall cover all pipe stored on the site with canvas or other opaque material to protect it from sunlight. Provide air circulation under the covering.

F. The Contractor shall inspect all pipe, fittings, and other accessories upon delivery and during the work. Any defective or damaged materials found during field inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.

G. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.

H. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-delivered-to-site and first-to-be-installed rotation basis. Mechanical-joint glands, bolts, and washers shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

1.05 DEFINITIONS OF BURIED, EXPOSED, AND SUBMERGED PIPING

A. Buried piping is piping buried in soil, beneath a structure and/or encased in concrete. Where an exterior pipe coating is specified to be factory- or field-applied, the Contractor shall provide the coating up to the penetration of a structure. Piping encased in concrete does not require an exterior coating other than what is factory furnished.

B. Exposed piping is piping in any of the following conditions or locations:

1. Above ground.
2. Inside buildings, vaults, or other structures.
3. In underground concrete trenches or galleries.

C. Submerged piping is considered to be all piping within a liquid holding tank.

1.06 SYSTEM DESIGN REQUIREMENTS

A. General

1. The Specifications and Drawings are not all inclusive of explicit piping details; provide piping for intended use in compliance with laws and regulations, including ASME B31.1.
2. Pressure ratings and materials specified represent minimum acceptable standards for piping systems.
3. Piping Systems: Suitable for the services specified and intended.
4. Piping shall be color coded in accordance with the Florida Department of Environmental Protection (FDEP) requirements.

B. Support Systems

1. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of responsibility for sizing and providing supports for this project.

2. Select and design within the specified spans and component requirements.

3. Comply with requirements of MSS SP-58.

4. Criteria for structural design and selection of pipe support system components:

   a. Dead loads imposed by the weight of the pipes filled with water, within specified spans and component requirements, plus any insulation.
   b. Safety factor: Minimum of 5.

5. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support, to withstand the

shear and pullout loads imposed by loading and spacing on each particular support.

a. Piping smaller than 30 inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required and are to be provided and installed by the Contractor at no additional cost to the Owner.

C. Adapters

1. No attempt has been made to show all adapters, spool pieces, reducers, bushings, or other fittings required to accommodate the connection of pipes, fittings, and valves of various joint design and sizes throughout the project. The Contractor is completely responsible for providing, at his expense, all adapters, reducers, sleeves, spool pieces, and other fittings and appurtenances necessary for connection of pipe (for the same pipe material of or a transition of pipe materials), valves, fittings, and appurtenances throughout the project, which shall be constructed of appropriate materials, coated and lined to match the materials, coatings, and linings specified for the connected components. All adapters, reducers, sleeves, spool pieces, and other fittings shall be coated and lined in accordance with the specifications for each individual pipe system.

D. Unions

1. No attempt has been made to show all unions required for the project. The Contractor shall provide unions at all connections of threaded pipe to installed equipment unless deleted by the Engineer, in writing, at certain locations. The unions shall meet or exceed the quality of materials, pressure rating, service, and painting requirements of connected piping.

PART 2 PRODUCTS

2.01 PIPING SYSTEM GENERAL REQUIREMENTS SCHEDULE

A. Unless noted otherwise in the Drawings, piping system materials, fittings, and appurtenances are subject to requirements of the individual Specifications for the piping systems.

2.02 PIPING SCHEDULE

A. A piping schedule (flow stream identification) listing the piping identification abbreviations, piping materials, operating pressures, field test pressures, lining systems, and color coding associated with the flow streams is provided on the

Contract Drawings. In project locations where the piping system material referenced on the piping schedule is not appropriate, the required piping material is indicated on the Contract Drawings. Materials called out in the Contract Drawings shall govern over materials stated in the piping schedule.

2.03 THREAD FORMING FOR STAINLESS STEEL BOLTS

A. Form threads for stainless steel bolts by rolling, not by cutting or grinding.

2.04 BOLTS AND NUTS FOR FLANGES FOR DUCTILE IRON PIPE FLANGES

A. Bolts, washers, and nuts for pipe installed indoors, outdoors above and below ground, and in vaults and structures shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.

B. Bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M (Grade B8) for bolts and ASTM A194/A194M (Grade 8) for nuts. Fit shall be Class 2A conforming to ASME B1.1 when connecting to cast-iron valves having body bolt holes.

2.05 BOLTS AND NUTS FOR TYPE 304 STAINLESS STEEL PIPE FLANGES

A. Bolts, washers, and nuts for flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

2.06 BOLTS AND NUTS FOR TYPE 316 STAINLESS-STEEL PIPE FLANGES

A. Bolts, washers, and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

2.07 BOLTS AND NUTS FOR PVC, CPVC, AND PVDF PIPE FLANGES

A. Bolts for piping in sodium hypochlorite service shall be made of titanium, in accordance with ASTM F467, Grade Ti1, Ti2, or Ti7. Nuts and washers shall conform to ASTM F467 and shall be made of titanium.

B. Bolts, washers, and nuts in chemical service other than sodium hypochlorite shall be Type 304 stainless steel conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

C. Bolts, washers, and nuts for buried and submerged flanges and flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel

conforming to ASTM A193/A193M, Grade B8, for bolts and ASTM A194/A194M, Grade 8, for nuts.

D. The Contractor shall provide a washer under each nut and under each bolthead. Washers shall be of the same material as the nuts.

2.08 BOLTS AND NUTS FOR STEEL PIPE FLANGES

A. Bolts, washers, and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, in vaults, and in structures shall be carbon steel, ASTM A307, Grade B. Bolts, washers, and nuts for buried service shall also be hot-dipped galvanized.

B. Bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193/A193M (Grade B8) for bolts and ASTM A194/A194M (Grade 8) for nuts. Fit shall be Class 2A in accordance with ASME B1.1 when connecting to cast-iron valves having body bolt holes.

2.09 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

A. Anti-seize thread lubricant shall be applied to the thread portion of all (above grade and below grade) stainless steel bolts (stainless steel tie rods, etc.) during assembly. Anti-seize lubricant shall be chloride free and shall be nongalling NSF approved. Anti-seize thread lubricant shall be Jet-Lube “Nikal,” John Crane “Thred Gard Nickel,” Never-Seez “Pure Nickel Special,” or Permatex “Nickel Anti-Seize.”

2.10 FLANGE GASKETS FOR STEEL, DUCTILE IRON, AND STAINLESS STEEL PIPE

A. Flange gaskets shall be in accordance with AWWA C207, except as modified in this Section. Gaskets shall be ring type. All gasket material shall be suitable for the fluid being conveyed and shall be resistant to free chlorine concentrations up to 10 mg/L. All gasket material shall be rated to the surge pressures listed in the pipe schedule. Gaskets shall be EPDM, Viton, or an approved equal.

2.11 FLANGE GASKETS FOR DUCTILE-IRON PIPE AND FITTINGS IN RAW SEWAGE

A. Gaskets shall be full face, 1/8 inch thick, Buna-N having a Brinell Hardness of 55 to 65 durometer. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 250°F. Gaskets shall have "nominal" pipe size inside diameters, not the inside diameters indicated in ASME B16.21. Provide Garlock Style 9122 or equal. The Contractor shall verify that the gaskets are compatible with all chemicals being used.

2.12 FLANGE GASKETS FOR PVC AND CPVC PIPE

A. Gaskets for flanged joints shall be full faced, 1/8 inch thick, having a Brinell Hardness of 50 to 70 durometer A. Gasket material shall be EPR unless noted or specified otherwise. Gasket material for sodium hypochlorite service shall be Viton ETP unless noted or specified otherwise. Gaskets shall be compatible with the fluids conveyed.

2.13 FLANGE GASKETS FOR PVDF PIPE

A. Gaskets for flanged joints shall be full faced, 5/64 inch thick (minimum), made of Teflon-bonded EPDM or PVDF-bonded EPDM. The EPDM shall have a Brinell Hardness of 65 to 70 Durometer "A." Gaskets shall be suitable for a fluid temperature range of -40˚F to +210˚F and compatible with the fluids conveyed.

2.14 FLANGE GASKETS FOR STAINLESS-STEEL PIPE IN CHEMICAL SERVICE

A. Gaskets shall be suitable for a maximum pressure of 300 psi and a maximum temperature of 500°F. The Contractor shall verify that the gaskets are compatible with the fluids conveyed. Gaskets for chemical service shall be one of the following materials:

1. Teflon-envelope type, full face, 1/8 inch thick, with compressed nonasbestos filler. Provide free-flow design in which the Teflon is machined or milled between leaves to provide a space for the filler.
2. Teflon (PTFE) with inert filler, 1/8 inch thick. Product: Garlock "Gylon 3510" shall be used for potassium hydroxide, sodium hypochlorite, and ammonium hydroxide. Garlock "Gylon 3545" shall be used for sulfuric acid, corrosion inhibitor, and hydrofluosilicic acid.

2.15 POTABLE WATER PIPING SYSTEMS

A. All potable water piping systems including pipe, valves, fittings, weld-solvents, linings, gaskets, lubricants, grout disinfection agents, and surfaces in contact with potable water shall meet all local and State of Florida regulations and requirements including NSF 61. The Contractor shall coordinate the color of the potable water system piping color with the Owner's color standard and shall provide color as approved by the Owner.

2.16 LOCATOR WIRE (OR DETECTABLE PIPELINE MARKING TAPE)

A. All 2-inch and larger buried piping shall be laid with two insulated, 12-gauge minimum AWG, THWN strand copper wires taped with adhesive-backed tape or tied to the nonmetallic pipe at 5 feet on center for location purposes.

B. All 1 inch and larger buried non-metallic piping shall be laid with underground detectable caution 2-inch tape a maximum of 12 inches deep and 6-inch tape a maximum of 24 inches deep.

PART 3 EXECUTION

3.01 PREPARATION

A. Field Alignment

1. The piping shown on the Contract Drawings is generally indicative of the work, with symbols and notations provided for clarity. However, the Contract Drawings are not an exact representation of all conditions involved; therefore, install piping to suit actual field conditions and measurements as approved by the Engineer. No extra compensation will be made for work due to differences between indicated and actual dimensions.
2. The Contractor shall install all adapters, fittings, flanged connections, closures, restrained joints, etc. not specified but necessary for a complete installation acceptable to the Engineer.
3. The Contract Drawings do not indicate all adapters, fittings, spool pieces, bushings, unions, supports, hangers, and other items required to accommodate the installing and connecting of pipe, fittings, valves, and equipment of various joint designs and sizes. Provide such required items of appropriate designs, materials, coatings, and linings.
4. An extensive network of underground piping, duct, conduit, direct-buried conductors, and related structures of various sizes, materials, alignments, age, and function exist within the project site. Conclusive information concerning these facilities is not available. Consequently, the design of new piping indicated on the Contract Drawings is approximate. Adjust alignment, fitting, valve, and joint locations as required and as approved by the Engineer to accommodate and protect existing facilities and provide the intended functionality of new piping.

3.02 FIELD LAYOUT AND MODIFICATIONS

A. Unless directed otherwise, the Contractor shall be responsible for setting construction layout stakes and/or offsets required to complete the designated work. The Contractor shall ensure that those stakes and/or offsets are protected and any re-staking required for any reason including work stoppage shall be included in the bid price and no additional compensation to the Contractor will be made.

B. The Engineer has the right to make any modifications the Engineer deems necessary due to field conditions, conflicts with other utilities, or to protect other properties.

3.03 PIPE PRODUCTS INSPECTION

A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe, fittings, gaskets, glands, bolts, and nuts supplied for this Contract have been inspected at the plant and that they meet the requirements of these Specifications. The Contractor shall submit these certificates to the Engineer before installing the pipe materials. The Contractor shall visually inspect all pipe and fittings at delivery and before they are lowered into the trench to be installed. Pipe or fittings that do not conform to these Specifications or have been damaged in any manner will be rejected and the Contractor must remove them immediately. The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods or quality assurance and uniformity of manufacturer fail to secure acceptable and uniform pipe products or where the materials used produce inferior pipe products.

3.04 BURIED PIPING AND PIPE FITTINGS

A. Trenching and backfilling for all pipe and fittings shall also be in accordance with Section 02305, Earthwork for Utilities.

B. Installation

1. Inspect all piping for defects and remove all lumps or excess coatings before installation. The inside of the mechanical joint and outside of plain-end pipe shall be cleaned before joining pipe. Caution shall be taken to prevent damage to the pipe during lowering into the trench. Remove all foreign matter that has entered the pipe during storage and installation. The Contractor shall cover the pipe ends during installation to prevent debris from entering the pipe. No debris, tools, clothing, or other material shall be placed in the pipe.
2. After being placed in the trench, the pipe shall be brought to the proper line and grade by compacting the approved backfill material under it, except at the bell end. Joint deflection shall not exceed 75% of the manufacturer's limit.
3. The Contractor shall install temporary water-tight plugs on the pipe ends during the time that the pipe is in the trench but no work is in progress. If there is water in the trench upon beginning work, this plug shall remain in place until the trench has been pumped dry, unless otherwise approved by the Engineer, the Engineer’s Representative, or the Owner’s Representative.

4. Buried carbon steel bolts and nuts shall be coated in accordance with Section 09900, Painting and Coating.
5. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.
6. Restrained plugs or caps shall be inserted into all buried dead end pipes, tees, or crosses. Provide blind flanges for all flanged exposed piping. Restrained plugs and caps installed for pressure testing shall be fully secured and blocked to withstand the test pressure.
7. Where plugging is required because of contract division or phasing for later connection, the ends of such lines shall be equipped with a suitable cast-iron or ductile-iron plug/cap or blind flange with or without a blowoff cock, as shown on the Drawings. Installation or removal of such plugging shall be considered incidental to the work and the Contractor shall not be compensated by the Owner for performing this work.

3.05 FLANGED JOINTS FOR EXPOSED PIPE AND FITTINGS

A. When bolting flanged joints, the Contractor shall avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate to ensure uniform compression of the gasket, in accordance with pipe and fitting manufacturer's recommendations.

B. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.

3.06 PIPING CONNECTIONS TO PUMPS AND OTHER EQUIPMENT

A. When connecting to pumps and equipment, the Contractor shall ensure that piping stresses are not transmitted to the pump and equipment. All connecting pipe shall be permanently supported and aligned so that accurate matching of bolt holes and uniform contact over the entire surface of pump flanges are obtained before any bolts are installed in the flanges or pipe is threaded into pump and equipment. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while the bolts are being tightened.

1. Pumps and equipment shall be leveled, aligned, and wedged into a position that will fit the connecting pipe, but shall not be grouted until the initial fitting and alignment of the pump and equipment may be shifted on its foundation if necessary to properly install the connecting pipe. Each pump and piece of equipment shall, however, be grouted before final bolting of the connecting piping.

2. After final alignment and bolting, the pump and equipment connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as required and then the flanges bolted back together. The flange bolts then shall be loosened and the process repeated until no movement is observed.
3. All carbon steel bolts and nuts shall be coated with the same exterior coating applied to the piping system.

3.07 ANCHORING AND RESTRAINING

A. Thrust blocks shall be used in new lines and shall be limited to areas in which a new fitting has been installed in an existing line and field restraining joints are not feasible or when directed by the Engineer.

3.08 FLUSHING, CLEANING, TESTING AND INSPECTION OF PIPING

A. See Section 15144, Pressure Testing of Piping, for the requirements of pipe flushing, cleaning, pressure testing, and inspection requirements.

3.09 DISINFECTION OF POTABLE WATER SERVICES

A. See Section 15141, Disinfection of Piping and Water Storage Facilities, for the disinfection requirements.

3.10 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

A. Welding

1. Use only certified welders meeting procedures and performance outlined in Section IX of the ASME BPVC and other codes and requirements in accordance with local building and utility requirements. Submit Welder's certificates to the Engineer for the project record before beginning any welding on the project. The Welder must be certified for all positions (flat, vertical, and overhead).
2. Have all welds conform to highest industrial practice in accordance with ASME B31.1 and ASME B31.3 or other codes and requirements in accordance with local building and utility requirements.

3.11 PIPE COLOR CODING

A. The pipe color shall be as identified on the Drawings. The Contractor shall coordinate with the Engineer and the Owner to generate a list of acceptable pipe colors for exposed piping systems. Where color-coding is achieved by painting exterior surfaces of the piping systems, painting shall be provided in accordance with Section 09900, Painting and Coating. On applicable pipes, color shall be in accordance with FDEP color-coding requirements.

END OF SECTION

SECTION 15060
PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for materials and installation of pipe hangers and supports, including accessory items such as anchor bolts and screws, pipe spiders, neoprene isolation pads, cable trays for hoses, and drip guards.

B. The Contractor shall furnish and install all pipe supports and pipe hangers as shown in the Drawings, as specified in this Section, and as specified in Section 15055, Piping Systems—General. Piping shall be supported, in general, as described in this Section and as shown on the Drawings. The manufacturer's catalog figure numbers are typical of the types and quality of standard pipe supports and hangers to be furnished and installed.

C. Number and Location: The Drawings typically show a limited number of the total support locations actually required. No attempt has been made to show all required pipe supports in all locations on the Drawings. The absence of pipe supports and details on any Drawings shall not relieve the Contractor of the responsibility for providing support of all piping systems included in the work for this project. Pipe supports shall be supplied for all piping systems to provide a rigid pipe system installation and additional support for pipe ends when equipment is removed for replacement, maintenance, and/or repair.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Provide line drawings of each piping system to the scale shown on the Drawings, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.

B. Provide installation drawings and manufacturer's catalog information on each type of hanger and support used. Clearly indicate the actual pipe outside diameter (not just nominal pipe size) that is used for the hangers and supports.

C. Submit layout drawings for the drip guards, showing dimensions and thicknesses. Show design of seam or joint where field connections will be made between sections and pieces of drip guards.

D. Submit a certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, and characteristics.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
4. ASTM A153/A153M—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
6. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
7. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
8. ASTM A575—Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
9. ASTM A576—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
10. ASTM A635/A635M—Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
11. ASTM A1011/A1011M—Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
12. ASTM D256—Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
13. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
15. ASTM F594—Standard Specification for Stainless Steel Nuts.

B. American Society of Mechanical Engineers (ASME)

1. ASME B31.1—Power Piping.

C. Manufacturer's Standardization Society

1. MSS SP-58—Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
2. MSS SP-127—Bracing for Piping Systems: Seismic – Wind – Dynamic Design, Selection, and Application.

1.04 QUALITY ASSURANCE

A. All hangers, supports, and appurtenances shall conform to the latest applicable requirements of ASME B31.1, except as supplemented or modified by the requirements of this Section.

B. All hangers, supports, and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported.

C. All pipe and appurtenances connected to equipment shall be supported so as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit certification stating that such requirements have been complied with.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All supports and hangers shall be crated, delivered, and uncrated to protect against any damage.

C. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

D. Finished iron or steel surfaces not galvanized or painted shall be properly protected to prevent rust and corrosion.

PART 2 PRODUCTS

2.01 GENERAL

A. Not all pipe supports or hangers required are shown on the Drawings. The Contractor shall provide pipe supports for every piping system installed. Support piping by pipe support where it connects to pumps or other mechanical equipment.

B. The Contractor shall ensure that pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes, fittings, and valves (all filled with water) plus valve actuators and any insulation and shall have a minimum safety factor of 5 based on the material's ultimate strength.

C. All of the equipment specified in this Section is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions. The Contractor shall develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 15 Pipe Sections.

D. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe of tubing material, valves, fittings, and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall conform to the applicable requirements of Section 05500, Metal Fabrications, and shall be furnished and installed under this Section.

E. Hangers and supports shall be spaced in accordance with ASME B31.1 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified in this Section.

F. Where flexible couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc. shall be rigidly supported.

G. All pipe and appurtenances connected to the equipment shall be supported so as to prevent any strain from being imposed on the equipment or piping system.

H. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for interior pipe supports shall be furnished with galvanized finish, hot-dipped, or electro-galvanized coated, except where field welding is required. Interior clamps on plastic pipe shall be plastic coated. Supports for copper pipe shall be copper plated or shall have a 1/16-inch plastic coating. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components for exterior pipe and pipe within outdoor structures shall be of Type 316 stainless steel.

I. Supports shall be sufficiently close together so that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.

J. All un-insulated non-metallic piping such as PVC, CPVC, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180º, arc shields shall be furnished. Where 360º arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length, and be securely fastened to pipe with stainless steel or galvanized metal straps not less than 1/2-inch wide.

K. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide galvanized protection shields as specified in Paragraph 2.01J above at each location.

L. Where pipe hangers and supports come in contact with copper piping, provide protection from galvanic corrosion by wrapping pipe with 1/16-inch-thick neoprene sheet material and galvanized protection shield or copper-plated or PVC-coated hangers and supports.

M. Pipe supports shall be provided as follows:

1. Cast-iron and ductile-iron piping shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
2. Steel and stainless steel piping 2-1/2 inches or larger diameter shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
3. Support spacing for steel and stainless piping 2 inches and smaller diameter and copper tubing shall not exceed 5 feet.
4. Supports for multiple PVC plastic piping shall be continuous wherever possible. Individually supported PVC pipes shall be supported as

recommended by the manufacturer except that support-spacing shall not exceed 3 feet. Multiple, suspended, horizontal plastic PVC pipe runs shall, where possible, be supported by ladder-type cable trays such as the Electray Ladder by Husky-Burndy; Cable Tray by Enduro Composite Systems; the Globetray by the Metal Products Division of United States Gypsum or equal. Ladder shall be of fiberglass reinforced plastic (FRP) construction. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs. Ladder-type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps, or fasteners similar to Globe, Model M-CAC; Husky-Burndy, Model SCR; or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.

5. All vertical pipes shall be supported at each floor or at intervals of not more than 12 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction.
6. Pipe supports shall not induce point loadings, but shall distribute pipe loads evenly along the pipe circumference.
7. Supports shall be provided at changes in direction and elsewhere as shown on the Drawings or as specified in this Section. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.
8. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split-type couplings, and sleeve-type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be used to support connecting pipes.
9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

N. Any required pipe support for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes and concrete and anchor hardware similar to items previously specified in this Section and shall be subject to the approval of the Engineer.

2.02 HANGER AND SUPPORT SYSTEMS

A. Pipe hangers and supports shall be as manufactured by Anvil, Unistrut, Cooper B-Line, Aikinstrut, Superstrut, or equal.

B. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced on the Drawings. The Contractor shall construct special hangers and supports if detailed in the Drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type Number	Description	Manufacturer and Model (or Equal)
1	Adjustable steel clevis	Anvil Fig. 590 or 260, B-Line B3100 or B3102
3	Steel double-bolt pipe clamp	Anvil Fig. 295A or 295H, B-Line B3144 or B3144A
4	Steel pipe clamp (pipes smaller than 3 inches)	Anvil Fig. 212, B-Line B3140
4	Steel pipe clamp (pipes 3 inches and larger)	Anvil Fig. 216, B-Line 3142
5	Pipe hanger	B-Line B6690
6	Adjustable swivel pipe ring	Anvil Superstrut 714, Anvil Fig. 104
7	Adjustable steel band hanger	B-Line B3172
8	Extension pipe or riser clamp	Anvil Fig. 261, B-Line B5573
9	Adjustable band hanger	Anvil Fig. 97
10	Adjustable swivel ring band hanger	Anvil Fig. 70, B-Line B3170 NF
11	Split pipe ring with adjustable turnbuckle	Anvil Fig. 108, B-Line B3173
13	Steel turnbuckle	Anvil Fig. 230, B-Line B3202
14	Steel clevis	Anvil Fig. 299, B-Line B3201
15	Swivel turnbuckle	Anvil Fig. 114, B-Line B3224
16	Malleable iron socket	Anvil Fig. 110R, B-Line B3222
17	Steel weldless eye nut	B-Line B3200
18	Steel or malleable iron concrete insert	Anvil Fig. 281, Superstrut 452
19	Top beam C-clamp	Anvil Fig. 92, B-Line B3033
20	Side I-beam or channel clamp	Anvil Fig. 14 or 217
21	Center I-beam clamp	Anvil Figure 134
22	Welded attachment type	Anvil Fig. 66 B-Line B3083
23	C-clamp	Anvil Fig. 86, B-Line B3036L
24	U-bolt	Anvil Fig. 137, B-Line B3188
26	Clip	Anvil Fig. 262, B-Line B3180
28	Steel I-beam clamp with eye nut	Anvil Fig. 228
29	Steel wide flange	Anvil Fig. 228 clamp with eye nut
30	Malleable iron beam clamp with extension piece	Superstrut CM-754, B-Line B3054
31	Light welded steel bracket	Anvil Fig. 194, B-Line B3063
32	Medium welded steel bracket	Anvil Fig. 195, B-Line B3066
33	Heavy welded steel bracket	Anvil Fig. 199, B-Line B3067
34	Side beam bracket	Anvil Fig. 202, B-Line B3062
36	Pipe saddle support	Anvil Fig. 258, B-Line B3095
37	Pipe stanchion saddle	Anvil Fig. 259, B-Line B3090
38	Adjustable pipe saddle support	Anvil Fig. 264, B-Line B3093/B3089

Type Number	Description	Manufacturer and Model (or Equal)
39	Steel pipe covering	Anvil Fig. 160, 161, 162, 163, 164, or 165; Superstrut A 789; B-Line B3160/B3165
40	Insulation protection shield	Anvil Fig. 167, B-Line B3151
41	Single pipe roll	Anvil Fig. 171, B-Line B3114
43	Adjustable roller hanger with swivel	Anvil Fig. 181, B-Line B3110
44	Pipe roll, complete	Anvil Fig. 271, B-Line B3117SL

C. Pipe hangers and supports shall be hot-dipped galvanized according to ASTM A153/A153M carbon steel (ASTM A36/A36M, ASTM A575, or ASTM A576). Bases, rollers, and anchors shall be steel as described above or may be cast iron (ASTM A48/A48M). Pipe clamps shall be steel as described above or may be malleable iron (ASTM A47/A47M).

D. Offset Pipe Clamp.

E. Anvil Figure 103, Cooper B-Line B3148, or equal. Material shall be Type 316 stainless steel unless otherwise noted.

2.03 MISCELLANEOUS PIPE SUPPORTS AND HANGERS

A. Pipe Anchor Chair: Anvil Figure 198 or equal.
B. One Hole Clamp: Anvil Figure 126 or equal.
C. Roller Chair: Anvil Figure 175 or equal.

2.04 STEEL CHANNEL FRAMING SYSTEM

A. Steel channel frames shall be 1-5/8 inches wide by 1-5/8 or 3-1/4 inches high by 12-gauge metal thickness, unless otherwise shown on the Drawings. Material shall conform to ASTM A36/A36M, ASTM A1011/A1011M (Grade 33 minimum), or ASTM A653 unless stainless steel is indicated on the Drawings. Stainless steel shall be Type 304. One side of the channel shall have a continuous open slot with inturned clamping ridges. Maximum allowable stress under any combination of applied uniformly distributed loads and concentrated loads shall not exceed those recommended in the AISC or AISI. Deflection shall not exceed 1/240 of span. The Contractor shall use multiple back-to-back channels to achieve these criteria if single channels are not sufficient. Products: Unistrut P1000 or P5000 Series, B-Line B11 or B22 Series, or equal.

B. Steel channels shall be hot-dipped galvanized according to ASTM A153/A153M.

C. Nuts shall be machined and case hardened. The Contractor shall provide rectangular nuts with the ends shaped to permit a quarter turn crosswise in the

framing channel. Provide two serrated grooves in the nut to engage the inturned edges of the channel.

D. Pipe clamps (including attachment screws and nuts) shall be Unistrut P1100 or P2000 Series, B-Line B2000 Series, or equal. Material shall be Type 304 stainless steel.

E. Hanger rods for trapezes shall be carbon steel (ASTM A36/A36M, ASTM A575, or ASTM A576) unless stainless steel is indicated on the Drawings. Stainless-steel hanger rod material shall comply with ASTM A276/A276M, Type 304.

F. Accessory fittings and brackets shall be the same material as the channel or trapeze. Provide coating on carbon steel fittings and brackets as specified for the channels and frames.

1. Flat Plate Fittings: Unistrut P1065, P1066, P1925; Superstrut AB-206, AB-207; or equal.
2. Post Bases: Unistrut P2072A, Superstrut AP-232, or equal.
3. 90º Brackets: Unistrut P1326, P1346; Superstrut AB-203; or equal.
4. Rounded-End Flat Plate Fittings: Unistrut P2325, Superstrut X-240, or equal.

G. Parallel pipe clamps shall be Unistrut P1563 through P1573, Superstrut AB-719, or equal. Material shall be Type 304 stainless steel.

2.05 FRP CHANNEL FRAMING SYSTEM

A. FRP pipe hangers and supports shall be Aickinstrut, Inc. or equal.

B. Material properties shall be as follows:

Longitudinal Direction	
Ultimate Tensile (psi)	37,500 minimum
Ultimate Compressive (psi)	35,000 minimum
Ultimate Flexural (psi)	37,500 minimum
Tensile Modulus (psi) x 10**6	3.00 minimum
Flexural Modulus (psi) x 10**6	2.00 minimum
Ultimate Shear Strength (psi)	6,000 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact (ASTM D256) ft-lb/inch notch	30 minimum

Transverse Direction	
Ultimate Tensile (psi)	10,000 minimum
Ultimate Compressive (psi)	20,000 minimum
Ultimate Flexural (psi)	14,000 minimum
Tensile Modulus (psi) x 10**6	1.0 minimum
Compressive Modulus (psi) x 10**6	1.4 minimum
Flexural Modulus (psi) x 10**6	1.0 minimum
Ultimate Shear Strength (psi)	5,500 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact, ft-lb notch	5 minimum
Hardness	
Barcol Test	50 minimum

C. Glass-fiber-reinforced composites and plastic products shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84.

D. Channel framing shall be 1-5/8 inches deep by 1-5/8 inches wide and shall be made using vinylester resin equal to Ashland Derakane 411, Ashland Hetron 922, or Reichhold Dion 9800. It shall have a nexus polyester surfacing veil over 100% of the surface which, along with a filler system, will protect against degradation from ultraviolet light. Channel shall be supplied with integral notches 1 inch on center. Notches shall be located on the interior flange to prevent slippage of pipe clamps and fittings after installation. In place of notched channel, unnotched channel may be used if the vertical channel sections supporting the horizontal piping are provided with stop lock hardware at each pipe clamp to prevent slippage. Channel framing shall be Aickinstrut G.R.P. Type V 2000 series or equal.

E. Channel framing connections shall be made with vinylester glass fiber composite nuts, bolts, all threaded rods, channel fittings, bases, and hanger assemblies. Nut, bolts, and rods shall be Aickinstrut 4200 series, Strut Tech PVCG, or equal. Channel fittings shall be Aickinstrut 2800 style or equal.

F. Load-bearing pipe clamps and nonload-bearing pipe straps shall be nonmetallic and nonconductive and shall be made by the injection-molding process using polyurethane-base resin. Pipe clamps and straps shall be Aickinstrut 3100 series or equal.

G. Clevis hangers shall be made with vinylester glass fiber and be Aickinstrut 1500 series or equal.

H. Hanger rods for trapezes shall be carbon steel (ASTM A36/A36M, ASTM A575, or ASTM A576) unless stainless steel or FRP is indicated on the Drawings. Stainless steel hanger rod material shall comply with ASTM A276/A276M, Type 304. FRP hanger rod shall be by Aickinstrut, StrutTech, or equal.

2.06 PIPE SPIDERS

A. Cooper B-Line B3281 to 3286, Superstrut S-794 or equal.

2.07 WAFFLE ISOLATION PADS

A. Mason Type "W;" Machinery Installation Systems "Unisorb" Type S, SB, F, or FB; or equal. Provide minimum 1/4-inch thickness.

2.08 NEOPRENE ISOLATING SLEEVES FOR METAL PIPE 6 INCHES AND SMALLER

A. Unistrut P2600, B-Line "Vibrocushion," or equal.

2.09 ANCHOR BOLTS AND SCREWS

A. Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A276/A276M or ASTM F593. Nuts shall be Type 316 stainless steel, ASTM A194/A194M, Grade 8M, or ASTM F594, Type 316 stainless steel.

PART 3 EXECUTION

3.01 PIPE HANGER AND WALL SUPPORT SPACING

A. The Contractor shall install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed on the Drawings. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed on the Drawings. If no spacing or rod sizes are given on the Drawings or in the Specifications for a particular piping system, use the following:

1. Pipe Hanger and Wall Support Spacing for Steel and Ductile-Iron Pipe (Sections 15155, Ductile Iron Pipe and Fittings; 15150, Sanitary Waste and Vent Piping; and 15276, Stainless Steel Pipe):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/8 and smaller	4	3/8
1/2 through 1	6	3/8
1-1/4 through 2	8	3/8
2-1/2 and 3	10	1/2
3-1/2 and 4	10	5/8
6	12	3/4
8	12	7/8
10 and 12	14	7/8
14 and 16	16	1

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
18	15	1
20 through 24	9	1
30	6	1

B. Pipe Hanger or Wall Support Spacing for PVC Pipe (Sections 15150, Sanitary Waste and Vent Piping; 15290, PVC Pipe, 3 Inches and Smaller):

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
3/4	4	3/8
1	4	3/8
1-1/2	5	3/8
2	5	3/8
2-1/2	5	1/2
3	6	1/2

C. For piping services not described, the Contractor shall provide hangers and supports according to MSS SP-58.

D. The Contractor shall provide bracing for piping 8 inches and smaller that is installed on hangers or trapezes according to MSS SP-127, except provide lateral bracing at maximum 10-foot center-to-center spacings. Provide sway bracing for hangers for piping larger than 8 inches as detailed on the Drawings.

3.02 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

A. The Contractor shall install pipe supports on horizontal runs at the spacing shown or detailed on the Drawings. Provide supports of the type shown or detailed on the Drawings. If no spacings are given on the Drawings or in the Specifications for a particular piping system, use the following:

1. Pipe Support Spacing for Steel and Ductile-Iron Pipe (Sections 15155, Ductile Iron Pipe and Fittings; and 15276, Stainless Steel Pipe):

Pipe Size (inches)	Maximum Support Spacing (feet)
3/8 and smaller	4
1/2 through 1	6
1-1/4 through 2	8
2-1/2 and 3	10
3-1/2 and 4	10
6	12
8	12
10 and 12	14

Pipe Size (inches)	Maximum Support Spacing (feet)
14 and 16	16
18	16
20 through 24	18
30	18

B. Pipe support spacing for other pipe materials shall be the same as described in Article 3.01, Pipe Hanger and Wall Support Spacing, in this Section.

3.03 INSTALLING PIPE HANGERS AND SUPPORTS

The Contractor shall do the following:

A. Provide separate hangers or supports at each valve. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one pipe diameter of the valve end. Provide additional hangers or supports to relieve eccentric loadings imposed by offset valve actuators.

B. Provide separate hangers or supports at each pipe elbow, tee, or fitting. Provide separate hangers or supports on both sides of each nonrigid joint or flexible pipe coupling.

C. Adjust pipe hangers according to MSS SP-58.

D. Install leveling bolts beneath support baseplates. Provide 3/4-inch-thick grout pad beneath each base.

E. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

3.04 INSTALLING STEEL AND FRP CHANNEL FRAMES

A. The Contractor shall use 1-5/8-inch-high channel frames, unless 3-1/4-inch is needed, to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

3.05 INSTALLING NEOPRENE ISOLATING SLEEVES

A. The Contractor shall install a sleeve around each metal pipe 6 inches and smaller at the point of bearing or contact with the pipe hanger or support.

3.06 PAINTING AND COATING

Painting and coating shall be performed in accordance with Section 09900, Painting and Coating, and as follows:

A. Grind the welds of fabricated steel pipe supports smooth, prepare surface by sandblasting, and apply coating system.

B. Paint exposed metallic pipe hangers and supports to match the color of the adjacent wall. If the adjacent wall is not painted, paint the hangers and supports to match the color code of the largest pipe on the support.

C. Coat submerged pipe hangers and supports.

D. Coat FRP pipe hangers and supports exposed to direct sunlight. FRP pipe hangers and supports that are hidden from direct sunlight need not be coated.

END OF SECTION

SECTION 15062
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes the following:

1. Metal piping hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Welding certificates.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing of Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

3. ASTM C552—Standard Specification for Cellular Glass Thermal Insulation.
4. ASTM C591—Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

B. American Society of Civil Engineers (ASCE)

1. ASCE 7—Minimum Design Loads for Buildings and Other Structures.

C. American Society of Mechanical Engineers (ASME)

1. ASME B31.9—Building Services Piping.
2. ASME BPVC—Boiler & Pressure Vessel Code.

D. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.

E. Manufacturers Standardization Society (MSS)

1. MSS SP-58—Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.

F. The Society for Protective Coatings (SSPC)

1. SSPC-PA 1—Shop, Field, and Maintenance Coating of Metals.

1.04 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME BPVC.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using the performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE 7.

1. Design supports for multiple pipes capable of supporting the combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting the combined operating weight of supported equipment and connected systems and components.

PART 2 PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material: ASTM C552, Type II cellular glass with 100 psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125 psig minimum compressive strength and vapor barrier.

B. For Trapeze or Clamped Systems: Insert and shield shall cover the entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover the lower 180º of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.05 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.06 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5,000 psi, 38-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36/A36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inchesthick in concrete after concrete is placed and completely cured. Use operators that are licensed by the powder-actuated tool manufacturer. Install fasteners according to the powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to the manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems; to permit freedom of movement between pipe anchors; and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Use thermal-hanger shield insert with clamp sized to match OD of insert.
b. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180º.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than 12 inches long and 0.048 inch thick.

5. Thermal-Hanger Shields: Install with insulation of the same thickness as piping insulation.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing for equipment supports to prevent swaying.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use the same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450-degree F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 pounds.
    b. Medium (MSS Type 32): 1,500 pounds.
    c. Heavy (MSS Type 33): 3,000 pounds.

7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

8. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hanger and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from base support.

N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 15065
FABRICATED GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, and incidentals required to provide the fabricated gates specified herein and shown on the Drawings. The fabricated gates for this project include, but are not limited to:

1. Stainless steel weir gates, sluice gates, and slide gates.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittal and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI 410—Stainless Steel.
2. AISI 416—Stainless Steel plus Related Metals.

B. American Society for Testing and Materials (ASTM)

1. ASTM A193—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High-Temperature or High-Pressure Service.
2. ASTM A240—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip.
3. ASTM A276—Standard Specification for Stainless Steel Bars and Shapes.
4. ASTM A380—Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
5. ASTM B584—Standard Specification for Copper Alloy Sand Castings.
6. ASTM D3935—Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material.

C. Welding Certification

1. ANSI/AWS D1.6—Structural Welding Code-Stainless Steel.

D. American Society of Mechanical Engineers (ASME)

1. ASME Section IX—Welding and Brazing Qualifications.

E. American Water Works Association (AWWA)

1. AWWA C561—Fabricated Stainless Steel Slide Gates.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and this Section for the storage and protection of the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 OPERATIONS & MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

1.09 SPECIAL DESIGN CONSIDERATIONS

A. All fabricated gates and appurtenances specified in this Section shall be furnished by a single manufacturer.

B. The fabricated gate embedded frame concrete cutouts in the structures shown on the Drawings are for representation purposes only. The Contractor shall be

responsible for determining the actual cutout dimensions required for each embedded fabricated gate frame before pouring the concrete walls, decks, and slabs around each frame.

C. The Contractor shall verify with the fabricated gate manufacturer that all fabricated gates of sufficient width and height function as intended. Refer to the Weir and Slide Gate Details and Schedule on the Drawings.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. As shown in the Weir and Slide Gate Schedule on the Drawings.

B. Performance Requirements: The leakage from slide gates in the fully lowered position shall not exceed the following:

1. 0.05 gpm per foot around the wetted gate perimeter when subjected to the design head (measured from the gate invert).

C. General Design Conditions

1. As shown in the Weir and Slide Gate Schedule on the Drawings.

D. Acceptable Manufacturers

1. RW Gate Company, Troy, NY.
2. WACO Products, Baltimore, MD.
3. Engineer-approved equal.

2.02 EQUIPMENT

A. General: The fabricated weir and slide gates specified in this Section shall be used to isolate flows in rectangular flow channels and basins by lowering or raising a disc or to control the rate of flow from one channel or unit process to another using a gate operator located above the operating floor. The slide gates specified in this Section shall be of the upward-opening type that shall close when the disc is lowered into the flow channel or basin. The weir gates specified in this Section shall be of the downward-opening type that shall close when the plate is raised to its upper position in a channel or basin.

B. Materials: The specifications below shall apply to each fabricated gate specified in this Section.

1. Disc: The gate disc shall consist of a flat plate reinforced with structural or formed members welded to the plate with structural shapes or U-shaped extrusions welded to the plate as required. The reinforcing members shall be of the same material as the disc. Each disc shall be a minimum thickness of 1/2 inch where the disc engages the slides and be designed to limit deflection of the disc to 1/720 of its span, or 1/16 inch, whichever is less, when subjected to the design conditions shown on the Weir and Gate Schedule on the Drawings. All disc components shall have a minimum material thickness of 1/4 inch. Working stresses shall not exceed 50% of the material's yield strength or 25% of the material's ultimate strength, whichever is less.

2. Frame: The gate frame shall consist of guides, an invert member, and operator yoke welded or bolted together to form a rigid one-piece frame. Each frame shall be furnished with guides that are built-up of plates, angles, and formed shapes in full accordance with the latest AWWA standards. Yoke members to be designed to limit the deflection to 1/360 of its span, or 1/8-inch, whichever is less, and shall be arranged to permit removing the disc from the frame.

a. General

(1) Self-contained Frames: The frame assembly for fabricated slide gates furnished with self-contained frames shall extend out of the gate opening to at least above the full-height of the disc in the "open" position. The frame assembly for fabricated weir gates furnished with self-contained frames shall extend out of the gate opening so that the openings can be fully opened and fully closed (weir invert lined up with or below top of mounting wall) with the discs. The yoke to support the gate operator shall be formed by structural shapes welded at the top of the guides to provide a one-piece rigid frame. Angles are not acceptable guide extensions. The arrangement of the yoke will be such that the disc and stem can be removed without disconnecting the yoke. The yoke members shall be designed for the maximum output of the gate hoist.

(2) Embedded Frames: Each fabricated gate to be mounted within a flow channel (guide slots recessed in the concrete walls on the seating and unseating side of the gate) shall be furnished with an embedded frame assembly suitable for

installing the fabricated gate in the flow channel. 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 disc are not acceptable. All seats and seals shall be mechanically fastened and field replaceable.

(3) Wall-Mounted Frame: Each fabricated gate to be wall-mounted shall be furnished with a frame assembly suitable for mounting the fabricated gate to the concrete surfaces at the end of the flow channel or wall opening.

b. Slide Gates: The frame assembly for slide gates shall be furnished with an invert structural member or formed shape welded to the bottom of the frame to form a flush surface and to meet with the disc seal. A specially molded resilient seal shall be mounted on the bottom of the disc to provide a flush-bottom closure. The shape of the slide-mounted seals shall produce a seating surface with a minimum width of 3/4 inch. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners.

3. Guides: Each side of the gate frame shall engage the disc a minimum of 1 inch.

a. Each fabricated gate shall be furnished with ultra-high molecular weight polyethylene (UHMWPE) strips securely attached by mechanical fasteners in the guide to provide a low-friction surface on which the disc will slide. The guide shall be designed for maximum rigidity and shall be provided with keyways to lock it into the concrete. The invert of the frame on upward opening gates shall be a structural member welded to the lower ends of the guides to form a mounting surface for the flush-bottom resilient seal.

b. For self-contained frames, the guides extending above the operating floor shall be sufficiently strong to be free-standing so that no further reinforcing will be required. Guides shall be sufficiently rigid to handle wind loads when the slide is in its highest travel position. The yoke to support the operating bench stand for standard frames shall be formed by two channels welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke shall be such that the disc and stem can be removed without disconnecting the yoke. The design of the yoke shall be such to limit its deflection to 1/360 of its span or 1/18 inch, whichever is less, under full operating load.

c. The guide shall weigh no less than 4.5 pounds per foot for aluminum gates, 6.5 pounds per foot for embedded or in-channel mounted stainless steel gates, and 13 pounds per foot for wall-mounted stainless steel gates and will be provided with holes for anchor bolts at a maximum of 16 inches for wall-mounted frames or embedded key ways for embedded frames.

d. Guides shall extend beneath the channel or basin opening a sufficient amount to support the disc in the fully open position for downward opening gates and shall extend above the channel to support the full height of the disc when the gate is in the fully open position.

4. Stems: Each fabricated gate shall be of the rising-stem type and shall be furnished with a stem extending from the yoke to the top of the gate disc at its lowest operating elevation. Each stem shall have a minimum diameter of 1-1/2 inches and shall be ASTM A276 Type 316 stainless steel. Each gate stem shall be designed to withstand twice the force transmitted to the gate disc from an 80-lb pull on the gate operator when subjected to the design head conditions in the Weir and Gate Schedule on the Drawings. Stems shall be cut-threaded or rolled-threaded with full depth Acme threads and threaded adequately to provide full travel of the gate disc. Stem threads shall be polished to a 16-microinch finish. The stem length/stem radius (L/r) ratio of the unsupported stem segment shall not exceed 200.

   a. Stem Guides: Stem guides shall be furnished as needed to limit the unsupported stem length to the specified L/r ratio.

   b. Stem Covers: Each fabricated gate shall be furnished with a stem cover to indicate the gate position (open/closed), permit inspection of the stem threads, and protect the stem from contamination. The stem cover material shall be clear polycarbonate meeting ASTM D3935. Vent holes shall be provided in each stem cover to prevent condensation, and a stem cap shall be provided at the top of the stem cover. Each stem cover shall be furnished with a clear mylar position-indicating marking tape. The marking tape shall be adhesively backed and shall be permanently marked and calibrated in feet and inches.

   c. Stem Couplings: Stem couplings, if needed, shall be fabricated from ASTM A276 Type 316L stainless steel and shall be threaded and keyed or threaded and bolted to ensure a true and stable connection.

5. Gate Operators:

a. General: The manual operators for each gate shall consist of a gearbox hoist with a stainless steel input shaft suitable for operation with a portable operator. Hoists shall have a minimum gear ratio of 2:1. Each hoist shall be operated by crank to raise or lower each fabricated gate as needed.

(1) All gate operators shall be designed for manual operation.
(2) All gate operators shall be located at a height of 36 inches above the operating platform elevation, unless noted otherwise in the Weir and Gate Schedule on the Drawings.
(3) All crank-operated hoists shall be geared and shall have a weatherproof cast iron or ductile iron housing or pedestal with a 2-inch bronze operating nut.
(4) Operators shall be grease lubricated and provided with grease fittings at readily accessible locations.
(5) The bench stand or floor stand hoists for standard frames shall be sized to permit operation of each fabricated gate subjected to the design head condition specified in the Weir and Gate Schedule on the Drawings, with a maximum 40-lb pull on the crank.
(6) All gates with openings that are 48 inches or wider with widths greater than two times their height shall be provided with two lifting devices connected by a stainless steel tandem shaft for simultaneous operation.

b. Hoist: Each hoist shall be furnished with thrust bearings, bronze hoist nuts, and an internally threaded bronze stop nut to limit the downward travel of the stem and slide. All hoist nuts shall be manganese bronze alloy C86500 conforming to ASTM B584. The hoist nut shall be supported on roller bearings. A lubrication fitting shall be provided for lubrication of hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of crank rotation to open the gate shall be clearly and permanently marked on the hoist.

c. Cranks: Crank operators shall be self-locking at any position of stem travel. Cranks shall be 316 stainless steel. Cranks shall be no less than 12 inches long and shall be keyed to the input shaft.

6. Seals: Provide seals in the guides of each frame to allow each fabricated gate to meet the performance requirements specified in this Section when

subjected to the design head conditions in the Weir and Gate Schedule on the Drawings.

a. Self-Adjusting Ultra-High-Molecular-Weight Polyethylene (UHMWPE) Seals: Each fabricated gate shall be furnished with self-adjusting UHMWPE seals and a nitrile compression cord within the guides to minimize leakage around the disc. Each seal shall be self-adjusting and replaceable in the field without removing the frame from the wall or wall thimble. The minimum self-adjustment for each seal shall be 1/8 inch. "J" type seals are not considered acceptable.

b. Bottom Seals: Each upward opening fabricated gate shall be furnished with a resilient EPDM or neoprene seal mounted into the invert member to provide flush-bottom closure. The shape of the seal shall produce a seating surface with a minimum width of 3/4 inch. The seal shall be designed to extend into the guide and the vertical face of the seal shall contact the surface of the vertical inside the guide to provide a proper seal at the corners.

C. Stainless Steel Fabricated Gates

1. General: The specifications below shall apply to the stainless steel fabricated gate components specified in this Section.
2. Materials: All metal components of each fabricated gate, including wall brackets and floor stands, shall be ASTM A240 or A276, AISI Type 316 stainless steel. All welded components shall be Type 316L stainless steel. The stainless steel fabricated gates and appurtenances specified in this Section shall be designed to withstand the corrosion, abrasion, and stresses from being submerged in raw sewage and exposed to acidic gases.
3. Stem Guides: Stem guides, where required to limit the unsupported stem length, shall be AISI Type 316 stainless steel with UHMWPE bushings. The stem shall be connected to the disc by a Type 316 stainless steel stem connector that is bolted to the stem, with a minimum of two bolts, and welded to the disc.

2.03 EQUIPMENT LABELS

A. General

1. Furnish a 1-1/2-inch-minimum-diameter stainless steel or brass for each fabricated gate. Use block type numbers and letters with 1/4-inch minimum high numbers and letters stamped on and/or filled with black enamel. Each tag shall bear the equipment identification label shown in the Weir and Gate Schedule on the Drawings.

2. Attach the tag to the operator by soldered split key rings so that the ring and tag cannot be removed. Alternately, permanently fasten the tag to the gate with rivets or stainless steel screws. No adhesives shall be permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

B. All fabricated gates shall be thoroughly cleaned of grout and debris and installed in strict conformance with the manufacturer's recommendations before installation. Stem threads shall be cleaned and coated with an anti-galling compound before installation.

C. Fabricated gate components shall be machined and/or adjusted as needed to meet the design tolerances specified in this Section and recommended by the manufacturer.

D. Install the equipment in the locations as shown on the Drawings and in accordance with manufacturer's instructions and recommendations and the approved shop drawings.

E. The Contractor shall apply a non-shrink grout, resilient gasket, or polyurethane sealant between the frame and wall surfaces as needed to produce a watertight seal. The seal type shall be as recommended by the fabricated gate manufacturer and shall be suitable for submerged applications.

F. The Contractor shall have weir invert elevations set by a professional licensed surveyor at weir invert setpoint elevations shown on the Drawings at startup. The Contractor shall mark stem covers with the invert setpoint elevations.

3.02 PAINTING AND SURFACE PREPARATION

A. The gate manufacturer shall passivate all welds on stainless steel in accordance with ASTM A380.

3.03 FIELD TESTING

A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified herein. The specified time for these services shall be as shown in Section 11000, Table 11000-1, Equipment Testing and Training Requirements.

The service representative shall be certified and employed by the manufacturer of the equipment specified herein. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. Pre-Startup Testing: The factory-authorized service representative shall inspect each fabricated gate and verify that the components have been furnished and installed in accordance with the Contract Documents and manufacturer's recommendations.

2. Startup Testing: Each basin or flow channel completely dewatered, the gate disc for each fabricated gate shall be fully raised and lowered along its guide system a minimum of three times to ensure that it operates freely and that the required clearance between the disc tongue and gate guide groove are maintained at all times. During the startup testing, the geared hoists shall be adjusted as needed so that the maximum pull needed to raise and lower the disc does not exceed the value specified in this Section.

3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

    a. With each basin or flow channel is submerged, each fabricated gate shall be operated so that is fully closed. When the downstream flow channel or basin has been isolated and dewatered below the gate disc invert, the Contractor shall measure the average leakage rate from each fabricated gate over a period of 30 minutes. If the leakage rate exceeds the design requirements specified herein, the Contractor shall adjust the gate components in the field as needed. If the leakage rate still exceeds the design requirements specified in this Section after the field adjustments have been performed, the Contractor shall furnish a factory-authorized service representative on site to inspect, repair, and adjust the fabricated gates as needed. These service representative services shall be furnished to the Owner at no additional cost.

3.04 TRAINING SERVICES

A. The factory-authorized service representative shall be on site to perform training services during the field testing services in accordance with Section 11000, General Equipment Requirements. Training services shall be in accordance with Section 11000, Table 11000-1, Equipment Testing and Training Requirements.

3.05 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 15075
PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for materials and installation of markers, labels, and signs for pipes, tanks, and valves; for mechanical equipment; for hazardous materials warnings; and for miscellaneous plant services.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American National Standard Institute (ANSI)

1. ANSI Z535.1—Safety Colors.

B. American Society of Mechanical Engineers (ASME)

1. ASME A13.1—Scheme for Identification of Piping Systems.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LABELS FOR PIPING

A. Labels for piping shall bear the full piping system name as shown in the Piping Schedule on the Drawings. The Contractor shall provide separate flow directional arrows next to each label. Color, size, and labeling shall conform to ASME A13.1 and ANSI Z535.1. Labels for piping inside buildings shall be vinyl cloth: W. H. Brady Co. B-500 vinyl cloth, Seton Name Plate Corporation Pipe Markers, or equal. Labels for piping located outdoors shall be weather- and UV-resistant acrylic plastic and shall be W. H. Brady Co. B-946, Seton Name Plate Corporation Pipe Markers, or equal.

B. Alternatively, the Contractor shall provide preprinted, semirigid, snap-on, color-coded pipe markers. Color, size, and labeling shall conform to ASME A13.1 and ANSI Z535.1. Label shall cover 360º (minimum). Labels shall be fabricated of weather- and UV-resistant acrylic plastic. Labels shall be Seton Nameplate Corporation SetMark pipe marks or equal.

2.02 LABELS FOR VALVES

A. The Contractor shall provide each valve listed on the Tag Number list with an identification tag. The tag shall be 2-inch-square or circular aluminum or 1/16-inch-thick fiberglass: W. H. Brady B-60, Seton Name Plate Corp. Series SVT, or equal. Aluminum tags shall have black-filled letters. The Contractor shall provide fiberglass tags for chemical system valves. The tag shall show the valve tag number and/or name or designation as given on the Drawings.

2.03 HOSE BIBB SIGNS—UNSAFE WATER

A. The Contractor shall provide a rigid sign labeled "DANGER--UNSAFE WATER" for each hose bibb. Size and lettering shall conform to OSHA requirements. Signs shall be Seton Nameplate Company 20-gauge baked enamel, minimum size 7 inches by 3 inches; Brady B-120 Fiber-Shield fiberglass, minimum size 7 inches by 3 inches, 1/8 inch thick; or equal.

2.04 LABELS FOR MECHANICAL EQUIPMENT

A. The Contractor shall provide a label for each pump, blower, compressor, tank, clarifier mechanism, or other piece of mechanical equipment. The label shall show the equipment name and tag number as coordinated with the Engineers. Labels shall be 1-1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags. Provide fiberglass tags for chemical system equipment: Brady B-120 Fiber-Shield, Seton Style 2065, or equal.

2.05 LABELS FOR TANKS

A. Signs shall be weather- and UV-resistant. Labels shall be Brady B-946, Seton Name Plate Corporation PSPL, or equal. Minimum size shall be 7 inches by 10 inches. Provide a sign on each quadrant of the tank bearing the tank tag number and the name of the liquid stored.

2.06 HAZARDOUS MATERIALS WARNING AND DANGER SIGNS

A. The Contractor shall provide 10-inch-square hazardous materials warning diamond signs complying with NFPA 704. Wall signs shall be 1/8-inch-thick fiberglass: Brady B-120 Fiber-Shield or equal. Signs attached to tanks, cabinets, or pieces of equipment shall be self-adhesive vinyl cloth. Provide four signs for each bulk chemical storage tank, one for each quadrant of the tank. Provide signs at the following locations:

Process	Number of Signs	Description or Tag Number	Tank, Equipment or Location	
			Location	Chemical
CC	4	CC-TK-1	Chemical Storage & Feed System	Sodium Hypochlorite
CC	4	CC-TK-2	Chemical Storage & Feed System	Sodium Hypochlorite

B. The Contractor shall provide 10-inch-by-14-inch signs reading "DANGER" followed by the name of the chemical, gas, or hazard. Signs shall be 1/8-inch-thick fiberglass: Brady B-120 or equal. Provide one sign at each of the following locations:

2.07 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed plastic tape intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing that most accurately indicates the type

of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

2.08 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing that most accurately indicates the type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

PART 3 EXECUTION

3.01 INSTALLING PIPE LABELS

A. The Contractor shall provide a label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.

B. On piping having external diameters less than 6 inches (including insulation, if any), the Contractor shall provide full-band pipe markers, extending 360º around pipe at each location.

C. On piping having external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers but not narrower than

three times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe or insulation.
2. Strapped-to-pipe or insulation application of semirigid type with Type 304 or 305 stainless steel bands.

3.02 INSTALLING VALVE AND EQUIPMENT LABELS

A. The Contractor shall attach labels to the valve or piece of equipment with Type 304 or 316 stainless steel chains unless otherwise noted. For sodium hypochlorite use thermoplastic chains to attach labels.

B. The Contractor shall attach valve labels to the valve handwheels. If the valve has no handwheel, attach the label to the valve by tying the tag wire or chain around the operating shaft or nut.

3.03 INSTALLING MISCELLANEOUS SIGNS

A. The Contractor shall attach miscellaneous signs according to the sign manufacturer's recommendations and in accordance with OSHA requirements.

3.04 INSTALLING WALL AND DOOR SIGNS

A. Attach to walls and doors using epoxy adhesive.

3.05 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. During backfilling of each exterior underground piping system, the Contractor shall install continuous underground-type plastic line marker directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install a single line marker.

3.06 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall install tape 4 to 6 inches below finished ground surface directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

END OF SECTION

SECTION 15080
OUTSIDE PIPE INSULATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and apply insulation to above-grade safety showers, hose bibbs, reduced-pressure backflow preventers, blower or low-pressure air piping, and other piping indicated on the Drawings or in the Specifications.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Insulation (each type).

B. Protective coverings.

C. Protective coatings.

D. Vapor barrier.

E. Adhesives, sealants, coatings, reinforcing mesh, and bands.

1. If requested by the Engineer, submit samples of A through E above for approval.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

1.04 QUALITY ASSURANCE

A. All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

B. Fire Hazard Rating: Except for materials listed below, all insulation materials, adhesives, coatings, and other accessories shall have a fire hazard rating not to exceed 25 for flame spread and 50 for fuel contributed and smoke developed. Excepted are:

1. Urethane insulation for smoke developed only.
2. Asphaltic and coal tar coatings.

C. All insulation shall be applied in strict accordance with these Specifications and with factory-printed recommendations on items not mentioned in this Section. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation. The company performing the work of this Section shall have a minimum of 3 years' experience specializing in the trade.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver materials in suitable containers to protect from damage.

C. Completely protect stored materials from the weather.

D. Do not allow adhesives and sealants to be subject to temperatures below 40°F.

PART 2 PRODUCTS

2.01 MATERIALS

A. Insulation Performance: Rigid cellular foam urethane with the following requirements:

1. Density: 1.8 to 2.2 pounds per cubic foot.

2. Dimensional stability: 4%.

3. Thermal conductivity (BTU in/hr. sw. ft. °F):

    a. Initial: .11
    b. Design: .14 to .16
    c. Aged: .18

4. Compressive strength: 25 psi with 10% deflection.

5. Open cell content: 10% or less by volume.

6. Temperature range: 30°F to +220°F.

B. Insulation Requirements

1. Supply all insulation in curved cylindrical segments.

2. Fabricate insulation in contact with the pipe to suit pipe outside dimensions.

3. Insulation thickness shall be 1-1/2 inches thick.

4. Acceptable Manufacturers:

    a. Owens Corning.
    b. CPR Upjohn.
    c. Or approved equal.

C. Insulation Adhesives, Sealants, and Coatings

1. Adhesives, sealants, and coatings shall be compatible with materials to which they are applied and shall not corrode, soften, or otherwise attack insulation in any manner. Materials shall be suitable for intended service.

2. Suitable for a -30°F to 200°F operating service.

3. Acceptable manufacturers:

    a. Childers Products Company.
    b. Benjamin Foster Company.
    c. Lion Oil Company.
    d. Or approved equal.

4. The Contractor shall adhere insulation to piping with suitable adhesive.

5. Seal all exposed edges of insulation with two coats of suitable flexible sealer.

6. Seal lap, butt, and longitudinal joints in insulation with one coat of flexible sealer or adhesive.

D. Insulation Protective Coverings

1. Exposed Outside Piping: Protect insulation with a 0.016-inch-thick corrugated aluminum jacket. Aluminum shall be Type 3003 or 5005, ASTM B209, Temper H14. Exterior shall have a factory-applied baked-on acrylic coating. The inside of the covering shall have a factory-applied moisture barrier of polyethylene film on Kraft Paper. Covering shall be as manufactured by Childers, Insul-Coustic, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not apply insulation until all surfaces to be covered are tested for leaks and approved, cleaned, dried, and all foreign material such as rust, scale, dirt, etc., has been removed.

B. Clean and dry insulation when installing and during the application of any finish.

C. Do not install insulation when temperature is less than 45°F.

D. Insulate fittings and flanges with sections fabricated from standard insulation sections, rigid urethane boards or blocks, or a combination of both.

E. Fit insulation to eliminate voids. Seal all joints.

F. For heat-traced piping, insulate fittings, joints, and valves with insulation compatible with the heating cables and associated equipment. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams on the bottom side of horizontal piping.

G. Exposed Outside Piping

1. Install aluminum covering only after the insulation application has been inspected and approved by the Engineer.
2. Seal lap-type covering systems on butt and longitudinal seams. Overlap shall be 2 inches minimum on side and edge laps with longitudinal cut edge turned under to provide a smooth edge.

3. Seal lock joint systems on longitudinal and butt or end seams.
4. Position all horizontal joints to shed water.
5. Fasten aluminum covering with 1/2-inch-wide-x-.105-inch-thick stainless steel bands installed on 9-inch center.

END OF SECTION

SECTION 15105
WALL PIPES, SEEP RINGS, AND PENETRATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes requirements for materials, installation, and testing of steel, cast-iron, and ductile-iron wall pipes and sleeves (including wall collars and seepage rings) and penetrations.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit detailed drawings for fabricated steel or cast-iron wall and floor pipes and sleeves, wall flanges, seep rings, and sealing materials. Show dimensions and wall thicknesses.

B. Show flange sizes and the appropriate ANSI or AWWA flange dimensional standard where flanged end wall pipes or penetrations are used.

C. Show grooved-end dimensions and AWWA grooved-end dimensional standard where grooved-end wall pipes or penetrations are used.

D. List coating systems to be applied, their manufacturer, and the dry thickness of coatings. Call out coatings where coatings are to be applied.

E. List materials of construction with ASTM material reference and grade.

F. Submit the manufacturer's instructions for installing rubber annular hydrostatic sealing devices:

1. Submit six copies of the results of the leakage test for cast-iron sleeves having shrink-fit steel collars or collar halves bottomed in a groove and steel sleeves having welded steel collars.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Petroleum Institute (API)

1. API SPEC 5L—Specification for Line Pipe.

B. American Society for Testing Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
3. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
5. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
6. ASTM A135/A135M—Standard Specification for Electric-Resistance-Welded Steel Pipe.
7. ASTM A139/A139M—Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over).
8. ASTM A181/A181M—Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
9. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
10. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
11. ASTM A395/A395M—Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
12. ASTM A436—Standard Specification for Austenitic Gray Iron Castings.
13. ASTM A536—Standard Specification for Ductile Iron Castings.
14. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
15. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

C. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
2. ASME B31.3—Process Piping.
3. ASME B36.10M—Welded and Seamless Wrought Steel Pipe.

D. American Waterworks Association (AWWA)

1. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).

E. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.

F. Plumbing and Drainage Institute (PDI)

G. Surface Preparation Standards and Specifications (SSPC)

1. SSPC SP-10/NACE No.2—Near-White Blast Cleaning.

1.04 QUALITY ASSURANCE

A. The Contractor shall be fully responsible for the proper execution and performance of the work described in this Section. The Contractor shall be responsible for inspecting all installation conditions and bringing to the attention of the Engineer any conditions that may adversely affect the Contractor's work. Before beginning any portion of this work, the Contractor shall report any conditions unsuitable for the installation of their portion of the work to the Engineer.

B. The location of all equipment, fixtures, and piping shall be considered as approximate only and the Engineer reserves the right to change these locations at any time before the work is installed. The positions of such equipment and piping to meet structural conditions and to provide proper headroom clearance or for other sufficient causes shall be changed without additional expense to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. The Contractor shall use cast-iron, ductile-iron, or fabricated-steel wall sleeves when containing rubber annular hydrostatic sealing devices through which piping passes:

1. Use only cast-iron or ductile-iron wall pipes when connecting to cast-iron and ductile-iron pipe. Use only fabricated-steel or stainless-steel wall pipes when connecting to steel or stainless steel pipe, respectively.

2. Cast-iron flanges shall conform to ASME B16.1, Class 125 or 250, to match the flange on the connecting pipe.
3. Class 150 steel flanges shall conform to AWWA C207, Class D. Class 300 steel flanges 48 inches and smaller shall conform to AWWA C207, Class F. Class 300 flanges larger than 48 inches shall conform to the dimensions of ASME B16.1 Class 250 flanges. Flanges shall be flat face. Flanges shall match the flange on the connecting pipe.
4. See Section 15055, Piping Systems—General, for flange bolts and gaskets.

2.02 CAST-IRON OR DUCTILE-IRON WALL PIPES AND SLEEVES

A. The Contractor shall provide cast- or ductile-iron wall pipes with ends as shown in the Drawings for connecting to adjacent cast-iron and ductile-iron pipe or for containing pipes where they pass through concrete walls, ceilings, and floor slabs. Provide seepage rings on wall pipes and sleeves passing through concrete walls and slabs that are to be watertight. Locate collars so that the collar is at the center of the wall or floor slab, unless otherwise shown on the Drawings.

B. Wall pipes and sleeves shall be of the following types:

1. Pipe or sleeve with integrally cast seep ring.
2. Pipe or sleeve with shrink-fit steel collar attached.
3. Pipe or sleeve with steel collar halves bottomed in a groove provided in the pipe or sleeve.

C. Minimum wall thickness for pipes and sleeves having integrally cast seep rings shall be as shown in the following table:

Pipe or Sleeve Size (inches)	Minimum Wall Thickness (inches)
3	0.48
4	0.52
6	0.55
8	0.60
10	0.68
12	0.75
14	0.66
16	0.70
18	0.75
20	0.80
24	0.89

1. Minimum wall thickness of pipes or sleeves having shrink-fit collars shall be special Class 52. Cut shrink-fit collars from a 1/4-inch-thick steel ring. Attach the collar to a cast-iron or ductile-iron pipe or sleeve by heating the

steel collar and allowing it to shrink over the pipe at the necessary location. Provide an epoxy bond (Keysite 740 or 742 or Scotchkote 302) between the pipe and collar. Sandblast the area of the pipe to be epoxy coated in accordance with SSPC SP-10/NACE No.2.

2. Wall pipes or sleeves having steel collar halves bottomed in a groove shall be ductile iron Special Class 54 minimum unless otherwise shown. Wall flanges shall consist of 1/4-inch-thick steel seep ring halves for pipes through 24 inches and 3/8-inch-thick halves for pipe 30 inches and larger, bottomed in a groove provided on the pipe. The pipe groove shall be machine cut to a depth of 1/16 to 5/64 inch to provide a press fit for the seep ring. Seep ring halves shall be welded together after being fit into the groove but shall not be welded to pipe. Seep rings shall be sealed completely around the pipe with silicon sealant manufactured by Dow-Corning No. 790, General Electric Silpruf, or equal.
3. The material used in cast- or ductile-iron wall flanges, wall sleeves, and wall penetrations shall conform to ASTM A395/A395M, ASTM A436, ASTM A536, ASTM A48/A48M (Class 35), or ASTM A126 (Class B).
4. Pressure test at least one of each size of cast-iron pipes or sleeves having shrink-fit steel collars or collar halves installed in a groove in the pipe at the place of fabrication to demonstrate watertightness of the seal between the collar and the sleeve. The test shall be at a pressure of 20 psig for 4 hours and shall show zero leakage.

D. Fabricated Steel Wall Pipes and Sleeves

1. The Contractor shall provide fabricated-steel wall pipes and sleeves with ends as shown on the Drawings for connecting to adjacent steel pipes or for containing pipes where they pass through concrete walls. Provide seepage rings or wall flanges on wall pipes and sleeves passing through concrete walls and slabs that are to be watertight. Wall thickness shall be the same as the pipe wall thickness when connecting to steel pipe. Minimum wall thickness for sleeves containing pipes shall be standard weight in accordance with ASME B36.10M for sleeves 72 inches and smaller and 1/2 inch for sleeves greater than 72 inches through 96 inches.
2. Wall flanges shall be in the form of a steel wall collar welded to the steel sleeve or penetration. Cut welded wall collars from a 1/4-inch steel ring. Attach the collar to a steel wall pipe or sleeve with full-circle, 3/16-inch fillet welds. Welding procedures shall be in accordance with ASME B31.3, Chapter V.
3. Steel pipe used in fabricating wall sleeves containing pipes shall comply with ASTM 53 (Type E or S), Grade B; ASTM A135/A135M, Grade B; ASTM A139/A139M, Grade B; or API SPEC 5L. Wall pipes connecting to steel pipe shall be of the same material as the connecting pipe. Wall

collar material shall comply with ASTM A36/A36M, ASTM A105/A105M, ASTM A181/A181M, or ASTM A182/A182M.

4. Stainless steel pipe used in fabricating wall pipes shall be of the same material as the connecting pipe. Wall collar material shall comply with ASTM A240/A240M.
5. The Contractor shall pressure test at least one of each size of fabricated steel wall sleeve or penetration and collar assemblies at the place of fabrication to demonstrate watertightness of the seal between the collar and the sleeve. The test shall be at a pressure of 20 psig for 4 hours and shall show zero leakage.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

1. PVC Pipe: ASTM D1785, Schedule 40.
2. Molded PE: Reusable PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

F. Rubber Annular Hydrostatic Sealing Devices

1. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, using interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut.

2. Materials of construction shall be as follows:

Compound	Material
Pressure plate	Composite glass-reinforced nylon
Bolts and nuts for links	Type 303 or 316 stainless steel
Sealing element	EPDM rubber

3. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

4. Provide centering blocks in 25% of the sealing elements on pipelines larger than 12 inches in diameter.

5. The rubber annular hydrostatic sealing devices shall be Link Seal as manufactured by Thunderline Corporation; Innerlynx as manufactured by Advance Products & Systems, Inc.; or equal.

G. Bolts, Nuts, and Gaskets for Flanged-End Wall Pipes

1. See Section 15055, Piping Systems—General.

H. Polyethylene Foam Filler for Pipe Penetrations

1. Packing foam shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam, as manufactured by Dow Chemical Company, Midland, Michigan or equal. The rod shall be 1/2 inch larger in diameter than the annular space.

I. Escutcheons: Escutcheons shall be as follows:

1. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping, and an OD that completely covers opening.

2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

3. One-Piece, Cast-Brass Type: With set screw.

a. Finish: Polished chrome-plated and rough brass.

4. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

a. Finish: Polished chrome-plated and rough brass.

5. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

6. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

7. One-Piece, Floor-Plate Type: Cast-iron floor plate.

8. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

J. Polyurethane Sealant for Pipe Penetrations

1. Sealant shall be multipart, polyurethane sealant, to cure at ambient temperature for continuous immersion in water. Install as recommended by the manufacturer. Products: SIKA Sikaflex 2C or equal.
2. Sealants at firewalls shall be a two-part foamed-silicone elastomer by Dow Corning Co., Product No. 3-6548 silicone R.T.V.; 3M brand fire barrier products caulk C.P. 25 and 3M brand putty 303; or Flame-Safe fires stop systems Fig. No. FS-500 by Thomas & Betts Corp. Sealant bead configuration, depth, and width shall be in accordance with the manufacturer's recommendations.

K. Painting and Coating

1. Line and coat sleeves and pipes (except stainless steel) with NSF 61 listed fusion-bonded epoxy. Fusion-bonded epoxy shall be 100% solids, thermosetting, fusion bonded, dry-powder epoxy resin; Scotchcoat 134 or 206N, Lilly Powder Coatings Pipeclad 1500 Red, or equal. Apply fusion-bonded epoxy in accordance with the manufacturer's instructions to a minimum thickness of 15 mils.

L. Grout: Grout shall be as follows:

1. Description: ASTM C1107/C1107M, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout:

a. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
b. Design Mix: 5,000 psi (34.5-MPa), 28-day compressive strength.
c. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 LOCATION OF PIPES AND SLEEVES

The Contractor shall do the following to ensure proper pipe installation:

A. Provide a wall or floor pipe where shown on the Drawings and wherever piping passes through walls or floors of tanks or channels in which the water surface is above the pipe penetration.

B. Provide a floor sleeve where shown on the Drawings and wherever plastic pipe, steel, or stainless steel pipe 3 inches and smaller or stainless steel or copper tubing

passes through a floor or slab. Provide a rubber annular sealing device in the annular space between the sleeve and the passing pipe or tubing.

C. Provide wall sleeves where shown on the Drawings and wherever plastic, steel, or stainless steel pipe 3 inches and smaller or stainless steel or copper tubing passes through a wall. Provide a single rubber annular seal when the wall is 8 inches thick or less. Provide two rubber annular seals (one at each end of the sleeve) when the wall is more than 8 inches thick. Pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

D. Where wall sleeves are installed in which water or soil is on one or both sides of the channel or wall, provide two rubber annular seals (one at each end of the sleeve).

E. Where pipes pass through walls or slabs and no sleeves or wall or floor pipe with seep ring is provided, pack the annular space with polyethylene foam filler and fill the ends of the penetration with 2 inches of elastomeric sealant on both sides of the structure.

F. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with concrete floors and roof slabs. Extend sleeves installed in the floors of mechanical equipment areas or other wet areas 2 inches above the finished floor level. Extend cast-iron sleeve fittings below the floor slab as required to secure a clamping ring if a ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).

   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal the annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for the size, depth, and location of joint.

3.02 INSTALLATION IN EXISTING CONCRETE WALLS AND SLABS

A. The Contractor shall core drill holes 1 to 2 inches larger in diameter than the outside diameter of the wall flange or collar. Install wall pipe and collar assembly axially aligned with the piping to which it will be connected or which it will contain. Pack the void space between the sleeve and concrete with grout. See Section 03300, Cast-In-Place Concrete, for grouting specification.

B. Installation in New Concrete Walls and Slabs

1. Install wall pipes and sleeves in walls before placing concrete. Do not allow any portion of the pipe or sleeve to touch any of the reinforcing steel. Install wall pipe or sleeve and collar assembly axially aligned with the piping to which it will be attached or will contain. Provide supports to prevent the pipe or sleeve from displacing or deforming while the concrete is being poured and is curing.

C. Installation in Dry Floors and Slabs

1. Install pipe sleeves and spools in concrete floors and slabs that do not have water over them so that the sleeve or pipe extends from the bottom of the floor or slab to 2 inches above the floor or slab unless shown otherwise on the Drawings.

D. Installation of Wall Pipes Having Flanged End Connections

1. Check alignment before grouting in place or pouring concrete. Realign if the sleeve is not properly aligned.
2. Install flanged end wall sleeves or penetrations with boltholes of the end flanges straddling the horizontal and vertical centerlines of the sleeve.

E. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for a 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals:

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select the type and number of sealing elements required for the pipe material and size. Position the pipe in the center of the sleeve. Assemble mechanical sleeve seals and install in the annular space between the pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

F. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for a 1-inch annular clear space between the pipe and sleeve for installing mechanical sleeve seals:

1. Mechanical Sleeve Seal Installation: Select the type and number of sealing elements required for the pipe material and size. Position the pipe in the center of the sleeve. Assemble mechanical sleeve seals and install in the annular space between the pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

G. Fire-Barrier Penetrations: Maintain the indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

H. Install escutcheons for the penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type with spring clips.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
h. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

I. Verify final equipment locations for roughing-in.

J. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

K. Qualifications of Welders

1. Welder qualifications shall be in accordance with AWS D1.1/D1.1M.

L. Field Testing

1. The Contractor shall check each wall penetration for leakage at the time the hydraulic structure is tested for leakage; see Section 03300, Cast-In-Place Concrete, Section 03200, Concrete Reinforcement, and Section 03480, Precast Concrete Structures. Penetrations shall show zero leakage.

END OF SECTION

SECTION 15110
MANUAL, CHECK, AND PROCESS VALVES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves as shown in the Drawings and as specified in this Section. All valves shall be complete with all necessary manual actuators, valve boxes, extension stems, and floor stands, which are required for proper valve operation and completion of the work.

1. All valves shall be of the sizes shown in the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

2. The valves shall include but not be limited to the following:

a. Air Valves.
b. Ball Valves.
c. Butterfly Valves.
d. Check Valves.
e. Diaphragm Valves.
f. Gate Valves.
g. Globe and Angle Valves.
h. Pinch Valves.
i. Plug Valves.
j. Solenoid Valves.
k. Special Types of Valves.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product technical submittal data shall contain the following information and data:

1. Acknowledgment that products submitted meet requirements of standards referenced.

2. Manufacturer’s installation instructions.

3. Manufacturer's operation and maintenance manuals.

4. Data of valves, actuators, and accessories:

a. Pressure and temperature rating.
b. Materials of construction, with ASTM reference and grade.
c. Linings and coatings.
d. Dimensions and weight.
e. Flow coefficient.
f. Actuators and accessories details.
g. Manufacturer's product brochure, cut-sheets, and parts diagrams.

B. Dimensions and orientation of valve actuators as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.

C. The following test reports: Performance Tests; Leakage Tests; Hydrostatic Tests; and Proof-of-Design Tests as applicable or required.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Petroleum Institute (API)

1. API SPEC 6D—Specification for Pipeline and Piping Valves.
2. API SPEC 6FA—Specification for Fire Test for Valves.
3. API STD 594—Check Valves: Flanged, Lug, Wafer, and Butt-Welding.
4. API STD 607—Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats.

B. American Society for Testing of Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A47/A47M—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48/A48M—Standard Specification for Gray Iron Castings.
4. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.

5. ASTM A108—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
6. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
7. ASTM A148/A148M—Standard Specification for Steel Castings, High Strength, for Structural Purposes.
8. ASTM A181/A181M—Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
9. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
10. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
11. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
12. ASTM A216/A216M—Standard Specification for Steel Castings, Carbon, Suitable for Fusion-Welding, for High-Temperature Service.
13. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
14. ASTM A269/A269M—Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
15. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
16. ASTM A313/A313M—Standard Specification for Stainless Steel Spring Wire.
17. ASTM A322—Standard Specification for Steel Bars, Alloy, Standard Grades.
18. ASTM A351/A351M—Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
19. ASTM A395/A395M—Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
20. ASTM A436—Standard Specification for Austenitic Gray Iron Castings.
21. ASTM A439/A439M—Standard Specification for Austenitic Ductile Iron Castings.
22. ASTM A449—Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
23. ASTM A479/A479M—Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
24. ASTM A494/A494M—Standard Specification for Castings, Nickel and Nickel Alloy.

25. ASTM A516/A516M—Standard Specification for Pressure Vessel Plates, Carbon-Steel, for Moderate- and Lower-Temperature Service.
26. ASTM A536—Standard Specification for Ductile Iron Castings.
27. ASTM A564/A564M—Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
28. ASTM A582/A582M—Standard Specification for Free-Machining Stainless Steel Bars.
29. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
30. ASTM A743/A743M—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
31. ASTM A744/A744M—Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
32. ASTM A890/A890M—Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.
33. ASTM B16/B16M—Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
34. ASTM B21/B21M—Standard Specification for Naval Brass Rod, Bar, and Shapes.
35. ASTM B61—Standard Specification for Steam or Valve Bronze Castings.
36. ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.
37. ASTM B98/B98M—Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
38. ASTM B99/B99M—Standard Specification for Copper-Silicon Alloy Wire for General Applications.
39. ASTM B127—Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
40. ASTM B148—Standard Specification for Aluminum-Bronze Sand Castings.
41. ASTM B150/B150M—Standard Specification for Aluminum Bronze Rod, Bar, and Shapes.
42. ASTM B164—Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
43. ASTM B169/B169M—Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
44. ASTM B193—Standard Test Method for Resistivity of Electrical Conductor Materials.
45. ASTM B371/B371M—Standard Specification for Copper-Zinc-Silicon Alloy Rod.
46. ASTM B427—Standard Specification for Gear Bronze Alloy Castings.

47. ASTM B443—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip.
48. ASTM B446—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar.
49. ASTM B462—Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.
50. ASTM B463—Standard Specification for UNS N08020 Alloy Plate, Sheet, and Strip.
51. ASTM B472—Standard Specification for Nickel Alloy Billets and Bars for Reforging.
52. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.
53. ASTM B763/B763M—Standard Specification for Copper Alloy Sand Castings for Valve Applications.
54. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
55. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
56. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
57. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.
58. ASTM D3222—Standard Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
59. ASTM D4101—Standard Specification for Polypropylene Injection and Extrusion Materials.
60. ASTM F441/F441M—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
61. ASTM F467—Standard Specification for Non-Ferrous Nuts for General Use.
62. ASTM F468—Standard Specification for Non-Ferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use.

C. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).

2. ASME B1.20.7—Hose Coupling Screw Threads (Inch).
3. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
4. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
5. ASME B16.10—Face-to-Face and End-to-End Dimensions of Valves.
6. ASME B16.11—Forged Fittings, Socket-Welding and Threaded.
7. ASME B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.
8. ASME B16.24—Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valve Classes 150, 300, 600, 900, 1500, and 2500.
9. ASME B16.34—Valves – Flanged, Threaded, and Welding End.
10. ASME B16.42—Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
11. ASME B16.47—Large Diameter Steel Flanges NPS 26 through NPS 60 Metric/Inch Standard.
12. ASME B36.10M—Welded and Seamless Wrought Steel Pipe.

D. American Society of Safety Engineers (ASSE)

1. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.

E. American Water Works Association (AWWA)

1. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.
2. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C115/A21.15—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
4. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
5. AWWA C500—Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C504—Rubber-Sealed Butterfly Valves.
7. AWWA C507—Ball Valves 6-Inch through 60-Inch (150 mm through 1,500 mm).
8. AWWA C508—Swing-Check Valves for Waterworks Service, 2-Inch through 48-Inch (50 mm through 1,200 mm) NPS.
9. AWWA C509—Resilient-Seated Gate Valves for Water-Supply Service.
10. AWWA C512—Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
11. AWWA C515—Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C550—Protective Interior Coatings for Valves and Hydrants.

13. AWWA C606—Grooved and Shouldered Joints.
14. AWWA C800—Underground Service Line Valves and Fittings.

F. Fluid Controls Institute (FCI)

1. FCI 70-2—Control Valve Seat Leakage.

G. Manufacturers Standardization Society (MSS)

1. MSS SP-61—Pressure Testing of Valves.
2. MSS SP-67—Butterfly Valves.
3. MSS SP-68—High Pressure Butterfly Valves with Offset Design.
4. MSS SP-81—Stainless-Steel or Stainless-Steel-Lined Bonnetless, Knife Gate Valves with Flanged Ends.
5. MSS SP-83—Class 3000 Steel Pipe Unions Socket Welding and Threaded.
6. MSS SP-108—Resilient-Seated Cast Iron Eccentric Plug Valves.

H. National Association of Corrosion Engineers International (NACE)

1. NACE MR-0103/ISO 17945—Petroleum, Petrochemical, and Natural Gas Industries – Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments.
2. NACE MR-0175/ISO 15156—Petroleum, Petrochemical, and Natural Gas Industries – Materials for Use in H2S-Containing Environments in Oil and Gas Production.

I. National Fluid Power Association (NFPA)

1. NFPA T3.6.7—Fluid Power Systems and Products – Square Head Industrial Cylinders – Mounting Dimensions.
2. NFPA T3.6.68—Fluid Power – Square Head Cylinders – Determination of the Static Failure Pressure Rating of Pressure-Containing Components.

J. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All valves, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be stacked or placed under pipe, fittings, or other valves in such a manner that damage could result.

C. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior linings and valve components. If any part of the coating, lining, or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer before attempting to install such valves.

D. Only new valves will be allowed for installation and shall be stored in a manner to prevent damage and be kept free of dirt, mud, or other debris.

1.06 QUALIFICATIONS

A. All of the valves shall be products of well-established firms which are fully experienced, reputable, have been selling this product for a minimum of 10 years, and are qualified in the manufacture of the particular product furnished. The valves shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

1.08 VALVE TYPE CLASSIFICATIONS

A. Air Valves (Type 100 series)

1. Type 100: Air-Release Valves for Water, Leachate Services, Compound Lever.
2. Type 121: Combination Air Valves for Water Services, Dual Body.
3. Type 125: Combination Air Valves for Water Services, Single Body.
4. Type 130: Air Valves for Vertical Turbine Pumps, Double-Acting Throttling.

5. Type 140: Air Valves for Sewage Services, Air Release.
6. Type 141: Air Valves for Sewage Services, Air and Vacuum.

B. Ball Valves (Type 200 series)

1. Type 200: Threaded Bronze Ball Valves, 2 Inches and Smaller.
2. Type210: Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service.
3. Type 212: Double-Union PVC Ball Valves, 3 Inches and Smaller, with Vented Ball for Chemical Service.
4. Type 213: PVC Labcock Ball Valves, 1/4 Inch.
5. Type 220: Regular Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller.
6. Type 221: Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service.
7. Type 227: Threaded Stainless-Steel Ball Valves, 1/4 Inch through 2 Inches.

C. Butterfly Valves (Type 300 series)

1. Type 300: Flanged, Rubber-Seated Butterfly Valves, 4 Inches through 72 inches, for Exposed Service.
2. Type 302: Mechanical-Jointed, Rubber-Seated Butterfly Valves, 4 Inches through 72 Inches, for Buried Service.

D. Check Valves (Type 400 series)

1. Type 400: Bronze Swing Check Valves, 3 Inches and Smaller.
2. Type 405: Stainless-Steel Check Valves, 2 Inches and Smaller.
3. Type 415: Stainless-Steel Swing Check Valves, 4 Inches and Smaller, Flanged, Class 150.
4. Type 416: Cast-Iron Swing Check Valves, 2 Inches through 24 Inches, Flanged, Class 125.
5. Type 420: Cast-Iron Swing Check Valves with Outside Lever and Weight, 4 Inches and Larger.
6. Type 425: Cast-Iron Swing Check Valves, 2-1/2 Inches and Larger, for Fire Protection Service.
7. Type 430: Ductile-Iron Swing-Flex Check Valves, 2 Inches through 36 Inches.
8. Type 450: Rubber Flapper Swing Check Valves.
9. Type 455: Duckbill-Shaped Check Valves, 1 Inch through 54 Inches, Class 125.
10. Type 456: Duckbill-Shaped In-Line Check Valves, 1 Inch through 24 Inches, Class 125.

11. Type 457: Duckbill-Shaped In-Line Check Valves with Cast-Iron Body, 1 Inch through 24 Inches, Class 125.

12. Type 468: Steel Wafer Single-Disc Check Valves, Class 125 and Class 150.
13. Type 470: Double-Union PVC Ball Check Valves.
14. Type 474: PVC Swing Check Valves, 3 Inches and Smaller.
15. Type 475: Stainless-Steel Ball Check Valves.
16. Type 490: Silent Check Valves, 3 Inches and Larger.

E. Diaphragm Valves (Type 500 series)

1. Type 500: Cast-Iron Diaphragm Valves, 3/4 Inch through 8 Inches.
2. Type 520: PVC Diaphragm Valves, 1/2 Inch through 4 Inches.
3. Type 525: PVC Diaphragm Valves, 1/2 Inch through 4 Inches, for Sodium Hypochlorite Service.

F. Gate Valves (Type 600 series)

1. Type 600: Bronze Gate Valves, 3 Inches and Smaller, for Exposed Service.
2. Type 620: Cast-Iron Resilient Wedge Gate Valves, 2 Inches through 3 Inches, Threaded End (AWWA C509).
3. Type 630: Cast-Iron Gate Valves, 4 Inches through 48 Inches.
4. Type 635: Cast-Iron Tapping Gate Valves, 3 Inches through 24 Inches.
5. Type 637: Ductile-Iron Resilient Wedge Tapping Gate Valves, 4 Inches through 16 Inches (AWWA C515).
6. Type 640: Cast-Iron Gate Valves, 4 Inches through 12 Inches, Class 250.
7. Type 650: Stainless-Steel Gate Valves, 1/2 Inch through 2 Inches.
8. Type 652: Stainless-Steel Gate Valves, 2 Inches through 6 Inches.
9. Type 660: Bronze Gate Valves, 2 Inches and Smaller, for Fire Protection Service.
10. Type 670: Aboveground Cast-Iron Gate Valves Larger than 2 Inches, for Fire Protection Service.
11. Type 675: Buried Cast-Iron Gate Valves 4 Inches through 12 Inches for Fire Protection Service.
12. Type 680: Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Exposed Service (AWWA C509).
13. Type 682: Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Buried Service (AWWA C509).
14. Type 690: Cast-Iron Solid Wedge Gate Valves, 2 Inches through 36 Inches.
15. Type 695: Stainless-Steel Knife Gate Valves, 2 Inches through 24 Inches.

G. Globe and Angle Valves (Type 700 series)

1. Type 700: Bronze Globe Valves, 3 Inches and Smaller.
2. Type 710: Bronze Angle Hose Valves, 1 Inch through 3 Inches.
3. Type 715: Bronze Angle Hose Valves, 1-1/2 Inch and 2-1/2 Inches, with Quick-Connect Coupling Adapters (for Non-Potable Water Service).
4. Type 720: Bronze Hose Bibbs, 1/2 Inch through 1 Inch.
5. Type 722: Bronze Hose Bibbs 3/4 Inch and 1 Inch with Quick-Connect Coupling Adapters (for Non-Potable Water Service).
6. Type 723: Hose Valves, 3/4 Inch, with Quick-Connect Coupling Adapters (for Non-Potable Water Service).
7. Type 730: Bronze Needle Valves, 3/4 Inch and Smaller.
8. Type 750: Brass Angle Valves for Use in Fire Protection Service.
9. Type 760: Bronze Angle Valves, 2 Inches and Smaller.

H. Pinch Valves (Type 800 series)

1. Type 800: Pinch Valves, 1 Inch through 8 Inches.

I. Plug Valves (Type 900 series)

1. Type 900: Eccentric Plug Valves, 3 Inches and Smaller.
2. Type 902: Eccentric Plug Valves, 4 Inches through 12 Inches.
3. Type 910: Cast-Iron Non-Lubricated Eccentric Plug Valves, 3 Inches and Smaller.
4. Type 920: Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger.

J. Solenoid Valves (Type 1000 series)

1. Type 1000: Metallic Solenoid Valves, 1-1/2 Inches and Smaller.

K. Other Special Types of Valves (Type 1100 series)

1. Type 1130: PVC Vacuum Breaker Valves, 1 Inch and Smaller.
2. Type 1140: Atmospheric Vacuum Breakers.
3. Type 1180: Gauge Valves.
4. Type 1185: Gauge with Annular Diaphragm Seal.
5. Type 1195: Back Pressure Valves, 1 inch and Smaller.
6. Type 1196: Back Pressure Valves, 2 Inches and Smaller.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves are identified in the Drawings by size and type number. For example, a callout of 36V300 refers to a 36-inch-diameter Type 300 valve. A Type 300 valve is a flanged, rubber-seated butterfly valve that is 4 inches through 72 inches for exposed service.

B. All valves shall be complete with all necessary geared actuators, chainwheels and chains, handwheels, levers, valve bonnets, valve boxes, extension stems, operating nuts, and T-handle wrenches, which are required for proper valve operating and completing of the work included under this Section. Renewable parts including discs, packing, and seats shall be of types specified in this Section and acceptable by valve manufacturer for the intended service. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached stainless-steel plate in raised embossed letters. All isolation valves shall be suitable for the intended service with bubble-tight shutoff to flow in either direction.

C. Bronze or brass components in contact with water shall comply with the following requirements:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	8% maximum
Copper + Nickel + Silicon	83% minimum

D. Valves and valve operators shall be factory prepared and primed and field finish coated in accordance with Section 09900, Painting and Coating.

2.02 VALVE ACTUATORS

A. The valve actuator shall be an integral part of a valve. The valve actuator shall be provided, installed, and adjusted by the valve manufacturer. Actuator mounting arrangements shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by the Engineer.

B. All valves shall open counter clockwise as viewed from the top. Unless otherwise required by the Owner, the direction of rotation of the wheel or wrench nut to open each valve shall be to the left (counterclockwise). Each valve body or

actuator shall have the word "Open" cast on it and an arrow indicating the direction to open.

C. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts, and washers shall be AISI Type 304 stainless steel. Unless noted otherwise, valves shall be equipped with the following manual actuators:

1. Exposed Valves 6 Inches and Smaller: Removable lever or handwheel actuators.
2. Exposed Valves 8 Inches and Larger: Geared actuators with handwheels.
3. Buried or Submerged Valves 6 Inches and Smaller: 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and T-handle wrench.
4. Buried or Submerged Valves 8 Inches and Larger: Geared actuators with 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and wrench.

D. Levers or handwheels shall be provided to actuate the valves where the valves are within 6 feet and 7 inches from finished grade or the operating floor. Handwheels shall be constructed of ductile-iron. Levers and handwheels shall be coated in accordance with Section 09900, Painting and Coating. Handwheel diameters for traveling nut actuators shall not exceed 8 inches for valves 12 inches and smaller and shall not exceed 12 inches for valves 20 inches and smaller.

E. Chainwheel and guide actuators shall be provided for all exposed valves installed with their centerlines more than 6 feet and 9 inches above finished grade. Chainwheels shall be cast-iron with stainless-steel stem, clip, and pins. The actuating chain shall be AISI Type 304 stainless steel. Stainless-steel chain baskets shall also be provided with these units. Chainwheels shall be coated in accordance with Section 09900, Painting and Coating.

1. Chainwheels and guides shall be Clow Figure F-5680, DeZurik Series W or LWG, Stockham, or equal.

F. Gear actuators for valves 8 inches through 20 inches shall be of the worm-and-gear or of the traveling-nut type. Gear actuators for valves 24 inches and larger shall be of the worm-and-gear type. Gear actuators for motorized valves shall be of the worm-and-gear type, regardless of size.

1. Gear actuators should be designed assuming that the differential pressure across the valves is equal to the test pressure of the connecting piping and assuming a line fluid temperature range of 33°F to 125°F, unless otherwise required in the detailed valve specifications.

2. Gear actuators shall be enclosed and oil lubricated with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves aboveground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug.
3. Traveling nut and worm-and-gear actuators shall be of the totally enclosed design and proportioned to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 80 pounds on the handwheel or crank. Stop-limiting devices shall be provided in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.
4. The self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B584, Alloy C86200) that is accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148/A148M, Grade 105-85) with thread ground and polished. Support worm-gear shafts at each end by ball or tapered roller bearings. The reduction gearing shall run in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.

G. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.

H. All buried valves shall have non-rising stems. All buried valves 3 feet below grade or deeper as measured at the valve centerline shall be furnished with an operator stem extension to extend the operating nut within 6 inches from the top of the valve box cover.

2.03 VALVE END CONNECTIONS

A. Provide valve end connections conforming to connected piping and as shown in the Drawings. Generally, all buried valves shall be mechanical joint type end connectors. Exposed valves shall be screwed-end, socket-weld end, or flanged to conform to adjacent exposed connected piping system.

B. Comply with the following standards:

1. Threaded: ASME B1.20.1.
2. Flanged: ASME B16.1 Class 125 unless other noted or AWWA C207.
3. Mechanical (gland) Type: AWWA C111/A21.11.
4. Soldered: ASME B16.18.

C. Nuts, Bolts, and Washers: Wetted or internal to be bronze or stainless-steel. Exposed to be zinc or cadmium-plated.

D. Epoxy Interior Coating: Provide epoxy coating for all interiors of ferrous valve body surfaces in accordance with AWWA C550. Coatings shall be NSF-approved for valves in all potable water piping services. Coatings shall not be required for stainless-steel valve interiors.

2.04 VALVE BOXES

A. All buried valves 2-inch size and larger shall be equipped with a standard cast-iron roadway valve box. Valve boxes shall be of the slip or sliding type with a round lid marked "Water" for potable water valves or “Sewer” for wastewater and a square lid marked “Reclaimed Water” for reclaimed water valves. The box shall be designed to prevent transfer of the surface loads directly to the valve or piping. Valve boxes must have a minimum adjustable range of 12 inches and a minimum inner diameter of 6 inches. All valve boxes and lids shall be produced from grey cast-iron conforming to the latest revision of specification for grey iron castings, ASTM A48/A48M, Class 20A-25A. All castings shall be true and free of holes and shall be cleaned according to good foundry practice, chipped and ground as needed to remove fins and rough places on castings. Valve boxes have to be rated to sustain FDOT H-20 loadings and have a minimum depth of 8 inches. The valve box lid shall fit flush in the top of the box without forcing and shall not rock, tip, or rattle.

B. Provide debris cap as required in the Drawings.

C. Coat buried cast-iron pieces as specified in Section 09900, Painting and Coating, or with fusion-bonded epoxy.

D. Valve boxes shall be as manufactured by Tyler Pipe, Geneco, , or equal.

2.05 EXTENSION STEMS

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where the valve is

submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be Type 316 stainless steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall withstand without damage a pull of 300 foot-pounds.

B. Extension stem diameters shall be as tabulated below:

Valve Size (inches)	Minimum Extension Stem Diameter (inches)
2	3/4
3, 4	7/8
6	1
8	1-1/8
10, 12	1-1/4
14	1-3/8
16, 18	1-1/2
20, 24, 30, 36	1-3/4
42, 48, 54	2

C. Provide buried valves or valves located inside manholes or vaults with valve boxes cast in the manhole or vault roof with a valve position indicator designed to fit standard 5-1/4-inch valve boxes. The indicators shall show valve position and the direction and number of turns required to fully open (or close). All internal gearing shall be sealed. Ship each unit ready for field installation complete with valve box cast-iron adapter, capscrews, guide bushing, position indicator, flexible washer, centering plate, and 2-inch AWWA nut. Valve box and indicator shall be provided by the valve manufacturer. Indicators shall be Westran Position Indicator, Pratt Diviner, or equal.

2.06 FLOOR STANDS

A. When required by the installations, provide floor stands for the operation of valves. Floor stands shall be of the non-rising stem, indicating type, complete with steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Floor stands shall be cast-iron base type: Clow, Figure F-5515; Bingham and Taylor; Stockham; or equal. Handwheels shall turn counterclockwise to open the valves.

B. Provide Type 316 stainless-steel anchor bolts.

C. Provide Type 316 stainless-steel extension stems for valves in exposed service. Provide Type 316 stainless-steel stems for valves in submerged service.

D. Provide adjustable stem guide brackets for extension stems. The bracket shall allow valve stems to be set over a range of 2 to 36 inches from walls. Provide bushings drilled to accept up to 2-inch-diameter stems. Base, arm, and clamp shall be Type 316 stainless-steel. Bushing shall be bronze (ASTM B584, Alloy C86400 or C83600). Bolts, nuts, screws, and washers (including wall anchor bolts) shall be Type 316 stainless steel. Provide slots in the bracket to accept 3/4-inch bolts for mounting the bracket to the wall. Products: Trumbull Industries, Inc., Adjustable Stem Guide or equal.

2.07 BOLTS, NUTS, AND GASKETS FOR FLANGED VALVES

A. Bolts, nuts, and gaskets for flanged valves shall be as described in Section 15055, Piping Systems—General.

2.08 PAINTING AND COATING

A. Coat metal valves located aboveground or in vaults and structures the same as the adjacent piping. If the adjacent piping is not coated, coat valves as specified in Section 09900, Painting and Coating. Apply the specified prime and finish coat at the place of manufacture. The finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

B. Coat buried metal valves at the place of manufacture as specified in Section 09900, Painting and Coating.

C. Coat submerged metal valves, stem guides, extension stems, and bonnets at the place of manufacture as specified in Section 09900, Painting and Coating.

D. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless-steel pieces, as specified in Section 09900, Painting and Coating. Apply lining at the place of manufacture.

E. Coat floor stands as specified in Section 09900, Painting and Coating.

F. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.

G. Measure the thickness of the valve interior linings as specified in Section 09900, Painting and Coating. Repair areas having insufficient film thickness as specified in Section 09900, Painting and Coating.

2.09 AIR VALVES (TYPE 100 SERIES)

A. General Description

1. All valves shall meet or exceed all applicable provisions of the latest revision of AWWA C512. All valves for drinking water services shall comply with NSF 61. Design pressure is 150 psig. Valves shall be operable for water temperatures of above freezing to 125°F.
2. All valves shall consist of a float or a float assembly. Valves shall be identified properly in plates attached permanently on the valve body. The body and cover shall be cast-iron ASTM A126, Class B, or ASTM A48/A48M, Class 35. Valves 3 inches and smaller shall have threaded ends. Valves 4 inches and larger shall have flanged ends. Threaded ends shall comply with ASME B1.20.1. Flanges shall comply with ASME B16.1, Class 125. All flanges shall be flat faced.
3. The float shall be Type 304 or 316 Stainless-Steel. For valves with inlet sizes less than 4 inches, the float shall be able to withstand a collapse pressure of 1,000 psig. For inlet sizes 4 inches and larger, the float shall be capable of withstanding collapse pressures of 750 psig. Trim shall be Type 304 or 316 Stainless-Steel. The valve seat shall be of EPDM or other rubber materials applicable to wastewater and sludge. The valve seat shall be easily removed and replaced in the field.
4. Drain/test ports on all valves with inlet size 1 inch or larger shall have two 1/2-inch NPT minimum plugged ports, one near the bottom of the valve body and the other near the top of the valve. The plug shall be of bronze, ASTM B584, Alloy C83600.

B. Type 100—Air-Release Valves for Water and/or Leachate Services, Compound Lever

1. Type 100 air-release valves for water services shall be inlet size 1 inch and 2-inch, of a compound lever with linkage mechanism to release air, Class 300. Orifice size shall be 1/8 or 3/32 inch. Valves shall be APCO 200A, Val-Matic Model 38, or equal.

C. Type 121—Combination Air Valves for Water Services, Dual Body

1. Type 121 combination air valves for water service shall be 4-inch inlet size and larger. It shall consist of an air and vacuum valve with an air-release valve attached to it. Connect the attached air-release valve to the air and vacuum valve with standard weight steel piping (ASME B36.10M) and an isolation gate or ball valve. Valves shall be APCO 1800 Series air/vacuum valve with a 200A air-release valve, Val-Matic Model 104S/38 – 108S/38, 110F/38 – 116F/38, or equal.

D. Type 125—Combination Air Valves for Water Services, Single Body

1. Type 125 combination air valve for water service shall be 1-inch through 4-inch inlet size. It shall consist of an air and vacuum valve with an air-release valve in a single-body double-orifice arrangement. The valve body and cover shall be constructed of ASTM A126 Class B cast-iron. The body inlet shall be baffled with a Buna-N float cushion. The floats shall be 300 series stainless-steel. The seats shall be Buna-N and provide drop tight shut-off. Valves shall be APCO 140C Series, Val-Matic Model 201C – 204C, or equal.

E. Type 130—Air Valves for Vertical Turbine Pumps, Double-Acting Throttling

1. Type 130 air valve for vertical turbine pump shall be 3-in inlet size or smaller. The discharge orifice shall have a double-acting throttling device to restrict air venting; it shall fully open to allow unrestricted air entry when the pump is shut down. The float shall rise with the water level in the valve body to close the orifice by sealing against a synthetic rubber seat. Valves shall be APCO 140 DAT Series, Val-Matic Model 100ST – 103ST, or equal.

F. Type 140—Air Valves for Sewage Services, Air Release

1. Type 140 air valves for sewage service shall have elongated cylindrical chambers. All valves shall provide the following: 1/2-inch clearance around the float in the chamber; minimum size 1/2-inch isolation valve and quick-disconnect couplings at the valve venting for back-flushing; blowoff port and valve at the bottom of the chamber; and inlet valve at the valve inlet. A back-flushing assembly shall be provided for all valves. The back-flushing assembly shall consist of an inlet shutoff valve, a flush valve, a clear water inlet valve, rubber supply hose, and quick-disconnect couplings. Type 140 valves shall be air-release valves. Valves shall be APCO 450 Series, Val-Matic Model 49ABW, or equal.

G. Type 141—Air Valves for Sewage Services, Air and Vacuum

1. Type 141 air valves for sewage service shall have elongated cylindrical chambers. All valves shall provide the following: 1/2-inch clearance around the float in the chamber; minimum size 1/2-inch isolation valve and quick-disconnect couplings at the valve venting for back-flushing; blowoff port and valve at the bottom of the chamber; and inlet valve at the valve inlet. A back-flushing assemble shall be provided for all valves. The back-flushing assemble shall consist of an inlet shutoff valve, a flush

valve, a clear water inlet valve, rubber supply hose, and quick-disconnect couplings. Type 141 valves shall be of air/vacuum valves. Valves shall be APCO 401, Val-Matic Model 301ABW, or equal.

2.10 BALL VALVES (TYPE 200 SERIES)

A. Type 200—Threaded Bronze Ball Valves, 2 Inches and Smaller

1. Ball valves 2 inches and smaller for air or water service shall have bronze (ASTM B62 or ASTM B584, Alloy C83600 or C84400) body and plug ball retainer. Ball and stem shall be brass, bronze or Type 316 stainless-steel. Provide chrome-plated ball if ball is brass or bronze. Valves shall have screwed ends (ASME B1.20.1), non-blowout stems, reinforced PTFE seats, and have plastic-coated lever operators. Valves shall have a pressure rating of at least 600 psi WOG at a temperature of 150ºF. Valves shall be Stockham T-285 Series, Nibco T-585-70 Series, Apollo 70-100 Series, or equal.

B. Type 210—Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service

1. Unless noted otherwise, ball valves installed in PVC piping systems 3 inches and smaller shall be constructed from polyvinyl chloride (PVC) ASTM D1784, rated to 150 psi minimum from 30º to 120ºF, double-union design with two-way blocking capability, socket end connection, double EPDM O-ring seals and EPDM backing cushions, PTFE seals, ABS handle, NSF 61 certified. Provide stem extensions when valves are installed in insulated piping. Stem extensions shall be of sufficient length to bring the bottom of the operating handle above the outside of the insulation. Valves shall be as manufactured by Asahi/America Inc., Quarter-Bloc Ball Valve Series, or approved equal.

C. Type 212—Double-Union PVC Ball Valves, 3 Inches and Smaller, with Vented Ball for Chemical Service

1. Vented PVC ball valves 3 inches and smaller for chemical service shall be rated at a pressure of 230 psi at a temperature of 70˚F and 150 psi at a temperature of 105°F. Provide a machined vent hole, deburred, in the ball to allow gases to vent. Body, ball, and stem shall be PVC conforming to ASTM D1784, Cell Classification 12454-A. Stems shall have double O-rings and be of blowout-proof design. Seats shall be PTFE and shall have an elastomeric backing cushion of the same material as the valve seals. O-ring seals shall be FKM. Valve ends shall be of the double-union design. Ends shall be socket-welded except where threaded or flanged-end

valves are specifically shown in the Drawings. Valves shall have handles for manual operation. Valves shall be Asahi/America Type 21 or approved equal.

D. Type 213—PVC Labcock Ball Valves, 1/4 Inch:

1. Labcock ball valves shall be PVC body with EPDM seals and seats. Valves shall be one-piece unibody design, have calibrated flow indicator level handle, and be full vacuum rated. Valves shall be rated at a pressure of 150 psi at a temperature of 70°F. Valves shall be manufactured by Asahi/America or approved equal.

E. Type 220—Regular Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller

1. Stainless-steel ball valves 2 inches and smaller for water service shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100ºF. Valve body, ball, and stem shall be Type 316 stainless-steel, ASTM A276/A276M or A351. Seat and seals shall be reinforced PTFE. Valves shall have plastic-coated lever actuators. Valves shall have screwed ends (ASME B1.20.1) and non-blowout stems. Valves shall be Flowserve Marpac B780 Series, Apollo 76-100 Series, or approved equal.

F. Type 221—Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service

1. Stainless-steel ball valves 2 inches and smaller for water or wastewater service shall be rated at a minimum pressure of 1,000 psi WOG at a temperature of 100°F. Provide full-port ball and body design. Valve body, ball, and stem shall be Type 316 stainless-steel, ASTM A276/A276M or ASTM A351/A351M. Seat and seals shall be reinforced PTFE. Valves shall have lever actuators, plastic coated. Valves shall have screwed ends (ASME B1.20.1) and non-blowout stems. Valves shall be Worcester Series 59, Apollo 86A-100 Series, or approved equal.

G. Type 227—Threaded Stainless-Steel Ball Valves, 1/4 Inch through 2 Inches

1. Stainless-steel ball valves 1/4 inch through 2 inches for carbon dioxide storage and feeding service shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100°F. Bodies shall be Type 316 stainless-steel (ASTM A351, Type CF8M). Ball, stem, and compression ring shall be Type 316 stainless-steel. Seats shall be filled TFE and seals shall be TFE. Valves shall be Neles-Jamesbury Type 3636 MT or equal.

2.11 BUTTERFLY VALVES (TYPE 300 SERIES)

A. General Description

1. Butterfly valves shall meet or exceed the latest revision of AWWA C504, Standard for Rubber-Seated Butterfly Valves, Class 150B, unless otherwise specified in this Section. Each valve shall operate in fully opened and in intermediate positions as the valve opens and closes without noticeable flutter or vibration of the disk and shall be free of backlash and loose connections in the operating mechanism, linkage, and shaft connections. Valves shall be identified properly by size, type, serial number, and manufacturer in stainless-steel plates attached permanently on the valve body or bonnet.
2. The valve body shall be ductile-iron according to ASTM A536 Grade 65-45-12. The valve disc shall be ductile-iron in accordance with ASTM A536 (65-45-12). The disc seating edge shall be solid 316 stainless-steel. The disc shall be securely attached to the valve shaft using 304 stainless-steel taper pins. The valve disc shall be designed without using external reinforcing ribs. The valve disc shall provide an uninterrupted 360° seating edge. The valve seat shall be of EPDM or Viton materials. The valve seat shall be designed to provide a tight shutoff in both directions at the specified design differential pressure, with a pressure of 0 psig on the face of the disc opposite the pressurized side. The valve seat shall be molded in and bonded to the valve body for 3- to 24-inch valves. For valves 30 inches and larger, the seat shall be field replaceable without disassembly of the disc and shaft and shall be retained within a dovetail groove in the valve body and locked in place by an epoxy compound edge. The valve shaft shall be of Type 304 stainless-steel. The valve shaft may be a one-piece unit extending completely through the disc or of the stub shaft type consisting of two separate shafts inserted into the valve disc hubs. Stub shafts shall extend into the disc hubs for a distance of at least 1.5 shaft diameters. The valve shaft shall have a diameter equal to or greater than that shown for Class 150B in Table 3 of AWWA C504. Connection between the shaft and disc shall be dowel or taper pins, which are mechanically secured. Alignment marks on the valve shaft and on the valve body shall be provided to indicate the fully closed and fully open positions. Valve shaft bearings shall be Teflon-lined with a non-metallic fiberglass composite backing and shall be permanently lubricated. The bearings shall be sleeve-type bearings contained in the hubs of the valve body. Design bearings in accordance with AWWA C504, Section 4.5.6. Thrust bearings shall be provided “as required” to hold the valve disc in the center of the valve seat. The valve shaft seal shall be self-compensating V-type packing with a minimum of four sealing rings. One-piece molded shaft seals and O-ring shaft seals are

not acceptable. The shaft seal shall be of a design allowing replacement of seals without removing the valve shaft. Packing shall be made of resilient, nonmetallic material and shall not contain asbestos. Metallic components (e.g., dowels, pins, etc.) shall be 300 series stainless-steel, ductile-iron, or other materials approved by the Engineer. Brass, bronze, and copper alloy materials are not acceptable. Non-metallic components shall be EPDM, Viton, Teflon, or other materials approved by the Engineer.

3. Valves shall be as manufactured by DeZurik, Pratt, M&H, Val-Matic or an approved equal.

B. Type 300—Flanged, Rubber-Seated Butterfly Valves, 4 Inches through 72 Inches, for Exposed Service

1. Type 300 valve bodies shall have flanged ends. Flanged-end valves shall be of the short-body design with 125-lb flanged ends faced and drilled in accordance with ASME B16.1 standard for cast-iron flanges.

C. Type 302—Mechanical-Jointed, Rubber-Seated Butterfly Valves, 4 Inches through 72 Inches, for Buried Service

1. Type 302 valve bodies shall have mechanical-jointed ends. The mechanical-joint end valves shall meet the requirements of AWWA C111/A21.11 standard.

2.12 CHECK VALVES (TYPE 400 SERIES)

A. Type 400—Bronze Swing Check Valves, 3 Inches and Smaller

1. Check valves 3 inches and smaller shall be all bronze with screwed ends and cap, Y-pattern body, and swing disc type. The disc shall be bronze, swing type. Valves shall be rated for 125 psi SWP/200 psi WOG, and shall be Crane Valves North America Figure 37, Nibco T413-B, Stockham B-319Y, or approved equal.

B. Type 405—Stainless-Steel Check Valves, 2 Inches and Smaller

1. Check valves 2 inches and smaller shall be Class 125, wye or straight pattern, stainless-steel, ASTM A351, Grade CF8M, with threaded cap or bolted bonnet. Ends shall be female threaded, ASME B1.20.1. The disc shall be stainless-steel swing type. Minimum working pressure shall be 125 psi WOG at a temperature of 150°F. Valves shall be Aloyco or approved equal.

C. Type 415—Stainless-Steel Swing Check Valves, 4 Inches and Smaller, Flanged, Class 150

1. Swing check valves 4 inches and smaller shall have bolted covers. Ends shall be flanged, Class 150, ASME B16.5. Body, disc, hinge pin, arm or hinge, and seats shall be Type 316 stainless-steel conforming to ASTM A351, Grade CF8M or ASTM A276/A276M, Type 316. Valves shall be Crane/Aloyco Figure 377, Powell Figure 2342 or 2633, or approved equal.

D. Type 416—Cast-Iron Swing Check Valves, 2 Inches through 24 Inches, Flanged, Class 125

1. Swing check valves 2 inches through 4 inches shall have bolted covers. Ends shall be flanged, Class 125, ASME B16.1. Body shall be cast-iron. Disc, hinge pin, and seats shall be brass or bronze. Minimum working pressure for valve sizes 2 inches through 12 inches shall be 200 psi WOG and 125 psi SWP. Minimum working pressure for valve sizes 14 inches through 24 inches shall be 150 psi WOG and 100 psi SWP. Valves shall be Crane Figure 373 or approved equal.

E. Type 420—Cast-Iron Swing Check Valves with Outside Lever and Weight, 4 Inches and Larger

1. Check valves 4 inches and larger shall be swing-check type with outside lever and weight and shall permit free flow of sewage forward and provide a positive check against backflow. Check valves shall be designed for a minimum working pressure of 150 psi. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body. Swing check valves shall exceed the minimum requirements of AWWA C508 with a heavy-duty body of cast-iron conforming to ASTM A126 Class B with integral flanges, faced and drilled in accordance with ASME B16.1 Class 125. Bolts, nuts, washers, etc., shall be 316 stainless-steel. The valve body shall be the full waterway type, designed to provide a net flow not less than the nominal inlet pipe size when swung open no more than 25º. The valve shall have a replaceable stainless-steel body seat, a cast-iron disc faced with a renewable resilient seat ring of rubber and held in place by stainless-steel screws. The disk arm shall be ductile-iron or steel, suspended from and keyed to a stainless-steel shaft, which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not

acceptable. The valve interior shall be painted with epoxy coating by the valve manufacturer in accordance with AWWA C550. The check valve shall be GA Industries, Inc. Figure 220 Lever and Weight or approved equal.

F. Type 425—Cast-Iron Swing Check Valves, 2-1/2 Inches and Larger, for Fire Protection Service

1. Swing check valves 2-1/2 through 12 inches for fire protection service shall be UL listed, FM approved, rated for at least 175 psi nonshock, cold water. Ends shall be flanged, Class 125, ASME B16.1. Materials of construction shall be as follows:

Description	Material	Specification
Body and cap	Cast-iron	ASTM A126, Class B
Disc	Bronze or cast-iron	ASTM B62; ASTM B584, Alloy C83600; or ASTM A126, Class B
Disc bushing, disc ring, and seat ring	Bronze	ASTM B62, or ASTM B584 (Alloy C83600)
Hinge pin	Brass	ASTM B16/B16M or ASTM B21/B21M

2. Valves shall be Stockham G-939, Walworth Fig. 8883 F, Nibco F-908, or equal.

G. Type 430—Ductile-Iron Swing-Flex Check Valves, 2 Inches through 36 inches

1. The valve body and cover shall be constricted of ASTM A536 Grade 65-45-12 ductile-iron. The disc shall be precision-molded Buna-N, ASTM D2000 Class BG. A screw-type backflow actuator shall be provided to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless-steel stem in a bronze bushing. The backflow device shall be of the rising-stem type to indicate position. A stainless-steel T-handle shall be provided for ease of operation. The valve shall be designed for a minimum working pressure of 150 psi. The manufacturer's name, initials, or trademark and also the size of the valve, working pressure, and direction of flow shall be directly cast on the body. Swing check valves shall exceed the minimum requirements of AWWA C508 with a heavy-duty body of ductile-iron with integral flanges, faced and drilled in accordance with ASME B16.1 Class 125. Bolts, nuts, washers, etc., shall be 316 stainless-steel. The valve body shall be the full waterway type. The disk arm shall be ductile-iron or steel,

suspended from and keyed to a stainless-steel shaft, which is completely above the waterway and supported at each end by heavy bronze bushings. The shaft shall rotate freely without the need for external lubrication. The shaft shall be sealed where it passes through the body by means of a stuffing box and adjustable packing. Simple O-ring shaft seals are not acceptable. The valve interior shall be painted with epoxy coating by the valve manufacturer in accordance with AWWA C550. The check valve shall be Val-Matic Swing-Flex check valve, or approved equal.

H. Type 450—Rubber Flapper Swing Check Valves

1. Valves shall consist of body, flapper, and bolted cover. Operating pressure shall be at least 250 psi at a temperature of 150°F. The valve seat shall be set at an angle of 35 to 45º to the centerline of the pipe. Ends shall be flanged, ASME B16.1, Class 125. The body and cover shall be cast-iron (ASTM A48/A48M, Class 30, or ASTM A126, Class B). The flapper shall consist of a steel disk insert and a steel bar hinge covered with Buna-N bonded to the metal pieces. Provide O-ring seal bonded onto the disk. Provide 1/8-inch-thick Buna-N lining in valve body. Lining shall have a hardness of 50 to 60 durometer, Shore A. Cover bolts shall be Type 316 stainless-steel. Products: APCO Series 100R, or approved equal.

I. Type 455—Duckbill-Shaped Check Valves, 1 Inch through 54 Inches, Class 125:

1. Valves shall consist of a contoured rubber body with a duckbill sleeve-type exit. The body entrance shall be round, with a connecting Class 125 ASME B16.1 rubber flange to match the connecting pipe. Material of construction of body, sleeve, and flange shall be Buna-N. Provide synthetic fabric reinforcement. Provide Type 304 or 316 stainless-steel backing rings on the rubber body flanges, as required by the Contract Documents. The valve shall open at a differential pressure of 2 inches of water column and shall close under a no-flow condition. Minimum body pressure rating shall be 50 psi. Maximum backpressure: 10 psi. Products: Red Valve Company “Tideflex” Model 35 or approved equal.

J. Type 456—Duckbill-Shaped In-Line Check Valves, 1 Inch through 24 Inches, Class 125

1. Valves shall consist of an in-line rubber flange with an attached duckbill sleeve-type exit. Design the valve to be installed between two mating flanges. The valve shall have a connecting Class 125 ASME B16.1 rubber flange to match the connecting pipe. Material of construction of the sleeve and flange shall be Buna-N or polyurethane. Provide synthetic fabric reinforcement. Provide Type 304 or 316 stainless-steel backing rings on

the rubber body flanges, as required by the Contract Documents. The valve shall open at a differential pressure of 4 inches of water column and shall close under a no-flow condition. Minimum body pressure rating shall be 50 psi. Maximum backpressure: 10 psi. Products: Red Valve Company "Tideflex" Model 37 or equal.

K. Type 457—Duckbill-Shaped In-Line Check Valves with Cast-Iron Body, 1 Inch through 24 Inches, Class 125

1. Valves shall consist of an in-line rubber flange with an attached duckbill sleeve-type exit, mounted in a cast-iron flanged body. Provide a cleanout plug on the top of the valve body. The valve body shall have two connecting Class 125 ASME B16.1 cast-iron flanges to match the connecting pipe. Material of construction of the sleeve and attached flange shall be EPDM, Buna-N, or polyurethane. Provide synthetic fabric reinforcement. Body material shall be cast-iron (ASTM A126) with 15-mil fusion-bonded epoxy lining and coating in accordance with AWWA C550. The valve shall open at a differential pressure of 4 inches of water column and shall close under a no-flow condition. Minimum body pressure rating shall be 150 psi for 4- and 6-inch sizes, 125 psi for 8-inch size, 100 psi for 10-inch size, 75 psi for 12- and 14-inch sizes, and 50 psi for 16- through 24-inch sizes. Maximum backpressure: 10 psi. Products: Red Valve Company "Tideflex" Model 39 or equal.

L. Type 468—Steel Wafer Single-Disc Check Valves, Class 125 and Class 150

1. Wafer single-disc check valves shall conform to API STD 594 and API SPEC D6 and shall be designed to be installed between the flanges of the adjoining pipe for piping 24 inches and smaller. Valves shall be equipped with an external spring mechanism to provide for non-slam closure of the valve without backflow, in any position, and shall not depend on gravity or backflow for closure. Provide a top-mounted flushing port with plug; coat plug threads with Teflon-paste lubricating compound before insertion. The spring mechanism shall be external and adjustable. Shaft packing shall be Teflon, externally adjustable and replaceable.

2. Materials of construction shall be as follows:

Component	Material	Specification
Body, spring arm, and flush port plug	Carbon-steel	ASTM A36/A36M or ASTM A216/A216M, Grade WCB
Disc	Stainless-steel	ASTM A240/A240M, Type 316
Disc arm, disc arm key, spring arm key, and spring seat ring	Stainless-steel	ASTM A313/A313M or ASTM A479/A479M, Type 316
Follower, gland bottom, inner bushing, bushing, retainer washer, and outer bushing	Bronze	ASTM B584, Alloy C93200
Shaft	Stainless-steel	ASTM A351, Grade CF8M
Shaft packing	Braided Teflon	--
Shaft seals and seat outside diameter seal	Buna-N	--

3. Valve shall be KF Series 20 as manufactured by KF Industries, Inc., or approved equal.

M. Type 470—Double-Union PVC Ball Check Valves

1. PVC check valves 3 inches and smaller shall be constructed of PVC in accordance with ASTM D1784, Type I, Grade 1. Ends shall be double-union, socket-welded. Seats and seals shall be Viton or EPDM, as approved by the Engineer. Valves shall have a pressure rating of 150 psi at a temperature of 75°F. Valves shall be as manufactured by Asahi/America or approved equal.

N. Type 474—PVC Swing Check Valves, 3 Inches and Smaller

1. Swing check valves 3 inches and smaller shall be constructed of PVC in accordance with ASTM D1784, Type 1, Grade 1. Ends shall be flanged, ASME B16.5, Class 150. Seats and seals shall be Viton or EPDM, as approved by the Engineer. Provide bolted bonnet. Valves shall have a pressure rating of 150 psi at a temperature of 73°F. Valves shall be as manufactured by Asahi/America or approved equal.

O. Type 475—Stainless-Steel Ball Check Valves

1. Stainless-steel ball check valves 1/4 inch through 2 inches shall be constructed of Type 316 stainless-steel body (ASTM A351 – CF8M). The tail piece, guide, and spring shall be constructed of 316 stainless-steel. Valves shall have a pressure rating of 400 psi WOG at a temperature of 100°F. Valves shall be Apollo Series 62-100, or approved equal.

P. Type 490—Silent Check Valves, 3 Inches and Larger

1. Valves shall be bronze mounted globe style. The seat and plug shall be hand replaceable in the field. Provide resilient seat. The flow area through the valve shall be equal to or greater than the cross sectional area of the equivalent pipe size. The valve plug shall be center guided with a through integral shaft and spring loaded for silent shutoff operation. Ends shall be flanged, Class 125 or 150, in accordance with ASME B16.1. Minimum pressure rating shall be 150 psi. Materials of construction shall be as follows:

Component	Material	Specification
Body	Cast-iron, Ductile-iron, or Cast-steel	ASTM A48/A48M, Class 30, or ASTM A126, Class B, ASTM A536, Grade 60-45-10, ASTM A216/A216M, Grade WCB
Plug and seal	Bronze	ASTM B62 or ASTM B584 (Alloys C83600 or C87600)
Spring	Stainless-steel	Type 316 stainless
Seating	Buna-N or EPDM	

2. Valve shall be APCO Series 600 or approved equal.

2.13 DIAPHRAGM VALVES (TYPE 500 SERIES)

A. Type 500—Cast-Iron Diaphragm Valves, 3/4 Inch through 8 Inches

1. Diaphragm valves 3/4 inch through 8 inches shall be of the weir type complying with MSS SP-83, Category B, with cast-iron (ASTM A48/A48M, Class 30, or ASTM A126, Class B) body bonnet and Teflon lining. Minimum lining thickness shall be 3/16 inch. Diaphragm shall be Buna-N or Viton, as coordinated with the Engineer.

Backing cushion shall be ethylene propylene terpolymer (EPT). O-rings shall be Teflon. Body-bonnet joint bolting stem, bushing, and travel stop shall be Type 304 stainless-steel (ASTM A193/A193M, Grade B8). Valve shall be manual handwheel operated with rising indicator stem or rising handwheel. Valves shall have a minimum pressure rating of 100 psi at a temperature of 120°F. Ends shall be flanged, Class 125, ASME B16.1. Valves shall be ITT Dia-Flo, Saunders Weir Type, or equal.

B. Type 520—PVC Diaphragm Valves, 1/2 Inch through 4 Inches

1. Diaphragm valves 1/2 inch through 4 inches shall be of the weir type with PVC bodies and PVC bonnets. PVC shall comply with ASTM D1784, cell classification 12454. Body wall thickness shall conform to Schedule 80 in accordance with ASTM D1785. Valve diaphragms shall be PTFE. Provide EPDM backing for PTFE diaphragms. O-rings shall be FKM. Body-bonnet bolting shall be Hastelloy C (ASTM F468, Grade N10276). Provide polypropylene manual handwheel actuator with rising indicator stem. Minimum pressure rating shall be 150 psi at a temperature of 73°F and 135 psi at a temperature of 110°F. Ends for valves 2 inches and smaller shall be true union with socket-weld connections. Ends for valves larger than 2 inches shall be flanged, Class 125, ASME B16.1. Valves shall be manufactured by Spears Manufacturing Company, ITT Dia-Flo, or approved equal.

C. Type 525—PVC Diaphragm Valves, 1/2 Inch through 4 Inches, for Sodium Hypochlorite Service

1. Diaphragm valves 1/2 inch through 4 inches shall be of the weir type with PVC bodies and PVC or polypropylene bonnets and molded flanged or true union ends. PVC shall comply with ASTM D1784, cell classification 12454-A. Polypropylene shall comply with ASTM D4101. The valve shall have a position indicator, travel stop, and bonnet O-ring sealing arrangement. Provide a manual polypropylene handwheel actuator with a rising indicator stem. Valves 1/2 inch through 2 inches shall be weir type with square body bonnet sealing design. Valves 2-1/2 inches through 4 inches shall be round bonnet body sealing design with threaded stud diaphragm connection. Valve diaphragms shall be PTFE coated. PTFE diaphragms shall accept the installation of a PVDF gas barrier between the layers of EPDM and PTFE. PVDF shall comply with ASTM D3222 Cell Classification Type II. Provide EPDM elastomer backing for diaphragms. O-rings and flange gaskets shall be FKM. Body-bonnet bolting and hardware shall be Hastelloy C (ASTM F468, Grade N10276) or Type 304 stainless-steel and non-wetted. Minimum pressure rating shall be 150 psi at a temperature of 70°F and 135 psi at a temperature of 110°F. Ends for

valves 1/2 inch through 2 inches shall be true union. Ends for valves 2-1/2 inches through 4 inches shall be flanged, Class 125, ASME B16.1. Products: Asahi/America Type 14 or approved equal.

2.14 GATE VALVES (TYPE 600 SERIES)

A. Type 600—Bronze Gate Valves, 3 Inches and Smaller, for Exposed Service

1. Valves 3 inches and smaller for exposed air and water piping systems shall be all-bronze construction with screwed end connections and screwed bonnet, single solid wedge gate with rising stem and handwheel operator for exposed service operation. Valves shall be rated for 125 psi SWP and 200 psi WOG and shall be manufactured by Crane Valves North America, Figure 428; Stockham, Figure B103; or approved equal.

2. Aboveground threaded-end gate valves 1/4 inch through 3 inches for water and air service shall be rising stem, screwed bonnet, solid wedge disc type, Class 125, having a minimum working pressure of 150 WOG psi at a temperature of 150°F. Ends shall be female threaded, ASME B1.20.1. Materials of construction shall be as follows:

Component	Material	Specification
Body and bonnet	Bronze	ASTM B61 or ASTM B62
Disc	Bronze	ASTM B61, ASTM B62, or ASTM B584 (Alloy C97600)
Stem	Bronze or copper silicon	ASTM B99/B99M (Alloy 651), ASTM B584 (Alloy C87600), ASTM B371/B371M (Alloy C69400)
Seat rings (Classes 200 and 300 only)	Stainless-steel	AISI Type 410

Handwheels shall be aluminum, brass, or malleable iron. Packing shall be PTFE or Kevlar aramid fiber. Valves shall be Crane, Stockham, or equal.

B. Type 620—Cast-Iron Resilient Wedge Gate Valves, 2 Inches through 3 Inches, Threaded End (AWWA C509)

1. Valves 2 inches through 3 inches shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and triple "O" ring seal staff box. Valves shall open counterclockwise. The valve wedge shall

be symmetrical and fully encapsulated with molded rubber with no exposed iron. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating each valve provided bubbletight shutoff during testing. Valve interior and exterior shall be epoxy fusion coated.

2. Ends shall be threaded ends complying with ASME B1.20.1.
3. Gate valves shall be manufactured by Mueller, American Flow Control or Kennedy.

C. Type 630—Cast-Iron Gate Valves, 4 Inches through 48 Inches

1. Valves shall conform to AWWA C500 and the following. Valves shall be cast-iron or ductile-iron bodied, bolted bonnet, nonrising stem, solid bronze internal working parts, parallel faced, bottom wedging double-discs, and O-ring seals. Discs for valves 12 inches and smaller shall be solid bronze; discs for valves larger than 12 inches shall either be solid bronze or shall be cast-iron or ductile-iron with bronze facings. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc. Bronze shall conform to ASTM B62 (85-5-5-5) or ASTM B584 (Alloy C83600), except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584, Alloy C87600). Body bolts shall be Type 316 stainless-steel, ASTM A276/A276M. End connections for exposed valves shall be flanged. End connections for buried valves shall be mechanical joint type to match the connecting pipe material. Valves shall be Clow AWWA gate valves, Mueller, or approved equal.

D. Type 635—Cast-Iron Tapping Gate Valves, 3 Inches through 24 Inches

1. Valves shall conform to AWWA C500 and the following. Valves shall be iron bodied, bolted bonnet, nonrising stem, solid bronze internal working parts, parallel faced, bottom wedging double-discs, and O-ring seals. Discs for valves 12 inches and smaller shall be solid bronze; discs for valves larger than 12 inches shall either be solid bronze or shall be cast-iron with bronze facings. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc. Bronze shall conform to ASTM B62 or ASTM B584 (Alloy C83600), except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584, Alloy C87600). Body bolts shall be Type 316 stainless-steel, ASTM A276/A276M. Ends shall be flanged, Class 125, ASME B16.1. One end shall have slotted bolt holes to fit tapping

machines. Seat rings shall be oversized to permit the use of a full-size cutter. Valves shall be Clow, American Flow Control, or equal.

E. Type 637—Ductile-Iron Resilient Wedge Tapping Gate Valves, 4 Inches through 16 Inches (AWWA C515):

1. Valves shall comply with AWWA C515 and the following. Valves shall be of the bolted bonnet type with nonrising stems. Valve stems shall be Type 304 or 316 stainless-steel or cast, forged, or rolled bronze. Stem nuts shall be made of solid bronze. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc. Bronze shall conform to ASTM B62 or ASTM B584 (Alloy C83600), except that the stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 10% elongation in 2 inches (ASTM B584 or ASTM B763/B763M, Alloy C87600 or C99500). Body bolts shall be Type 316 stainless-steel. Ends shall be flanged, Class 125, ASME B16.1. One end shall have slotted bolt holes in accordance with AWWA C515, Paragraph 4.4.1.3.4 to fit tapping machines.
2. Provide reduction-thrust bearings above the stem collar. Stuffing boxes shall be O-ring seal type with two rings located in the stem above the thrust collar. Each valve shall have a smooth unobstructed waterway free from any sediment pockets.
3. Valves shall be lined and coated at the place of manufacture with either fusion-bonded epoxy or heat-cured liquid epoxy. Minimum epoxy thickness shall be 8 mils.
4. Manufacturers: Clow, AVK, American Flow Control, Mueller, Waterous, Kennedy, or equal.

F. Type 640—Cast-Iron Gate Valves, 4 Inches through 12 Inches, Class 250:

1. Valves shall be cast-iron or ductile-iron body, bronze mounted, non-rising stem, bolted bonnet, solid wedge disc, with non-asbestos packing. Minimum non-shock working pressure shall be 500 psi. Materials of construction shall be as follows:

Component	Material	Specification
Bodies and discs	Cast-iron or ductile-iron	ASTM A126, Class B or ASTM A536, Grade 65-45-12
Disc bushing, disc ring, seat bushing, and seat ring	Bronze	ASTM B62

Component	Material	Specification
Stem	Bronze	ASTM B371/B371M, ASTM B584, or ASTM B763/B763M (Alloys C69400, C86200, C86300, C86400, C86500, C86700, C87600, C87500, C99500)
Body bolts and nuts	Stainless-steel	ASTM A276/A276M, Type 316

2. Ends shall be flanged, Class 250, ASME B16.1. Valves shall be Stockham Figure F-661, Crane 3E, or approved equal.

G. Type 650—Stainless-Steel Gate Valves, 1/2 Inch through 2 Inches:

1. Stainless-steel gate valves 1/2 inch through 2 inches shall be of the single-wedge type with rising stem and handwheel. Minimum working pressure shall be 200 psig. The bonnet shall be of the screwed type. Ends shall be threaded, ASME B1.20.1. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, plug, disc, and follower	Stainless-steel	ASTM A351, Grade CF8M
Packing gland, nut, retainer ring, and stem	Stainless-steel	ASTM A276/A276M, Type 316
Handwheel	Malleable iron	ASTM A47/A47M, ASTM A197
Stuffing box packing	Teflon	--

2. Valves shall be Powell Figure 1832, Crane/Alloyco Figure 90, or equal.

H. Type 652—Stainless-Steel Gate Valves, 2 inches through 6 inches

1. Stainless-steel gate valves 2 inches through 6 inches shall be of the wedge type, Class 150 with rising stem and handwheel. The bonnet shall be of

the bolted type. Ends shall be flanged in accordance with ASME B16.5. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, yoke, and wedge	Stainless-steel	ASTM A351, Grade CF8M
Stem and gland follower	Stainless-steel	ASTM A276/A276M, Type 316
Handwheel	Malleable iron	ASTM A47/A47M
Nuts and bolts	Stainless-steel	ASTM A194/A194M, Grade 818F or ASTM A193/A193M, Grade 88
Packing	Teflon	--

2. Valves shall be Powell Figure 1832, Crane/Alloyco Figure 90, or equal.

I. Type 660—Bronze Gate Valves, 2 Inches and Smaller, for Fire Protection Service

1. Gate valves for fire protection service shall be UL listed, FM approved, block pattern, screwed bonnet, outside screw and yoke, solid wedge design. Valves shall be rated for at least 175 psi, nonshock cold water. The valve body, wedge, bonnet, packing gland, and yoke bonnet shall be constructed of bronze (ASTM B62 or ASTM B584, Alloy C83600). The valve stem and stem collar shall be constructed of bronze (ASTM B371, Alloy C69400, or ASTM B584, Alloy C87600). The valve handwheel shall be constructed of cast or malleable iron. Valves shall be Jenkins 275-U, Stockham B-133, or equal.

J. Type 670—Aboveground Cast-Iron Gate Valves Larger Than 2 Inches, for Fire Protection Service

1. Gate valves 2-1/2 inches through 12 inches for fire protection service shall be UL listed, FM approved, OS&Y, rising stem, with solid wedge disc, bolted-bonnet design. Valves shall be rated for at least 175 psi, non-shock

cold water. Ends shall be flanged, Class 125, ASME B16.1. Materials of construction shall be as follows:

Component	Material	Specification
Body, handwheel, yoke bonnet, and yoke cap	Cast-iron	ASTM A126, Class B
Disc ring, packing gland, seat ring, yoke bushing, and backseat bushing	Bronze	ASTM B62, or ASTM B584 (Alloy C83600)
Wedge or disc	Bronze or cast-iron	ASTM B62; ASTM B584, Alloy C83600; or ASTM A126, Class B
Stem	Copper silicon or brass	ASTM B16/B16M or ASTM B584 or ASTM B763/B763M Alloys C87600, C99500, or C87500

2. Valves shall be Stockham G-634, Walworth Fig. 8713 F, Jenkins Figure 8L5-A, or equal.

K. Type 675—Buried Cast-Iron Gate Valves 4 Inches through 12 Inches for Fire Protection Service

1. Gate valves 4 inches through 12 inches for fire protection service shall be UL listed, FM approved, non-rising stem for use with indicator posts, solid wedge disc, bolted bonnet, with indicator post flange. Valves shall be rated for at least 175 psi, non-shock cold water. Ends shall be flanged, Class 125, ASME B16.1 or mechanical joint. Materials of construction shall be as follows:

Component	Material	Specification
Body, bonnet, disc, and indicator post flange	Cast-iron	ASTM A126, Class B
Disc bushing, disc ring, backseat bushing, and seat ring	Bronze	ASTM B62 or ASTM B584 (Alloy C83600)

Component	Material	Specification
Stem	Copper silicon or brass	ASTM B21/B21M or ASTM B584 or ASTM B763/B763M (Alloys C87600, C99500, or C87500)

2. Valves shall be Stockham G-632 or G-634, Nibco F-609, Clow F-6100 or F-6102, or equal.

L. Type 680—Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches for Exposed Service (AWWA C509):

1. Valves 3 inches and larger for exposed service operation shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and "O" ring stem seals. Valves shall open counterclockwise. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment, the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating that each valve provided bubbletight shutoff during testing. The valve interior shall be epoxy coated on the entire ferrous surface of the waterway. The valve exterior shall be coated in accordance with Section 09900, Painting and Coating.
2. Exposed valves 3 inches and larger shall be flanged.
3. Gate valves shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

M. Type 682—Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Buried Service (AWWA C509)

1. Valves 2 inches and larger for buried service operation shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and "O" ring stem seals. Valves shall open counterclockwise. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment, the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating that each valve provided bubbletight shutoff during testing. The valve interior shall be epoxy coated on the entire ferrous surface of the waterway. The valve exterior shall be coated in accordance with Section 09900, Painting and Coating, and encased with polyethylene as specified in this Section for ductile-iron pipe and fittings. Buried valves shall be equipped with standard 2-inch-square operating nuts.

2. Buried valves 2 inches and larger shall have mechanical joint ends, conforming to AWWA C111/A21.11. Valves shall be furnished complete with bolts, nuts, and gaskets.
3. Gate valves shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

N. Type 690—Cast-Iron Solid Wedge Gate Valves, 2 Inches through 36 Inches

1. Solid wedge gate valves for water, sludge, and raw sewage service shall be of the bolted-bonnet design. Exposed valves shall be of the rising-stem design with outside screw and yoke. Buried valves shall be of the non-rising-stem design with 2-inch AWWA operating nut. Stem bronze shall conform to ASTM B584, Alloy C87500 or ASTM B16/B16M. Materials of construction for other components shall be as follows:

Component	Material	Specification
Body, bonnet, yoke, and stuffing box	Cast-iron	ASTM A126, Class B or C
Disc pin	Brass	ASTM B16/B16M
Packing gland, backseat bushing, seat ring, yoke bushing, disc bushing, and disc ring	Bronze	ASTM B62 or ASTM B584 (Alloy C83600)
Capscrews, bolts, and nuts	Stainless-steel	ASTM A193/A193M, Grade B8M, ASTM A194/A194M, Grade B8M
Stems	Bronze	See above

2. Valves shall be flanged, ASME B16.1, Class 125. Products: Stockham G-623, Crane 465 1/2, Kennedy Figure 561X, or equal for exposed service; Crane 461, Kennedy Figure 566, or equal for buried service.

O. Type 695—Stainless-Steel Knife Gate Valves, 2 Inches through 24 Inches

1. Knife gate valves shall be of the solid one-piece cast body design. Minimum working pressure shall be 150 psi. Provide bevel gear actuators

for valves 14 inches and larger. Materials of construction shall be as follows:

Component	Material	Specification
Body	Stainless-steel	ASTM A743/A743M, Grade CF8M
Yoke, superstructure, fasteners, and packing gland	Stainless-steel	AISI Type 304 or 316 stainless-steel
Gate	Stainless-steel	ASTM A240/A240M, Type 316
Stem	Stainless-steel	ASTM A582/A582M, Grade S20300
Handwheel	Cast-iron	ASTM A126, Class B
Packing	Flax or acrylic PTFE	--

2. Valves shall be bonnetless wafer type with through bolting flange, for installation between two adjacent flanges. Flange holes in the body shall be Class 125, ASME B16.1. Valve leakage shall be in accordance with MSS SP-81. Valves shall have a resilient seat (neoprene or nitrile) for drip-tight shutoff. Valves shall be manufactured by DeZurik, ITT Fabri-Valve Model C67S, or approved equal.

2.15 GLOBE AND ANGLE VALVES (TYPE 700 SERIES)

A. Type 700—Bronze Globe Valves, 3 Inches and Smaller

1. Globe valves 3 inches and smaller shall be all-bronze construction with screwed-end connections, union bonnet, integral seat, rising stem with replaceable seat and disc. Valves shall be Class 150 rated for 150 psi SWP/300 psi WOG and shall be NIBCO Figure T-235-Y; Stockham Figure B-22T; or approved equal.

B. Type 710—Bronze Angle Hose Valves, 1 Inch through 3 Inches:

1. Angle-type hose valves 1 inch through 3 inches shall be brass or bronze (ASTM B62 or ASTM B584, Alloy C83600) body with rising or non-rising stem, composition disc, and bronze or malleable iron handwheel. The stem shall be bronze, ASTM B62, ASTM B584 (Alloy C83600), or ASTM B584 (Alloy C87600). Valves shall have a cold-water service pressure rating of at least 150 psi. Threads on the valve outlet shall be

American National Standard fire hose coupling screw thread. Valves shall be Nibco T-301-W, Powell Figure 151 with nipple adapter, Crane 17TF with hose nipple adapter, or approved equal.

C. Type 715—Bronze Angle Hose Valves, 1-1/2 Inch and 2-1/2 Inch) with Quick-Connect Coupling Adapters (for Non-Potable Water Service)

1. Angle-type hose valves 1-1/2 and 2-1/2 inches shall have brass or bronze (ASTM B62 or ASTM B584, Alloy C83600) body with rising or non-rising stem, composition disc, and bronze or malleable iron hand wheel. The stem shall be bronze, ASTM B62, or ASTM B584 (Alloy C87600). Valve shall have cold-water service pressure rating of at least 150 psi. Threads on valve outlet shall be American National Standard fire hose coupling screw thread (ASME B1.20.7). Provide with quick-connect female adapter to fit the quick connect male adapter on rubber water hose. Products: Nibco T-301-W, Powell Figure 151, Crane 17TF, or approved equal.

D. Type 720—Bronze Hose Bibbs 1/2 Inch through 1 Inch

1. Hose bibbs 1/2 inch, 3/4 inch, and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron handwheel, and bronze stem (ASTM B99/B99M, Alloy C65100; ASTM B371/B371M, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be PTFE or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ASME B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Valves shall be manufactured by Nibco or approved equal.

E. Type 722—Bronze Hose Bibbs, 3/4 and 1 inch, with Quick-Connect Coupling Adapters (for Non-Potable Water Service):

1. Hose bibbs 3/4 and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron hand wheel, and bronze stem (ASTM B99/B99M, Alloy C65100; ASTM B371/B371M, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be Teflon or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ASME B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Provide with quick-connect female coupling to fit the quick-connect male adapter

on the rubber water hose. Valves shall be manufactured by Nibco or approved equal.

F. Type 723—Hose Valves, 3/4 Inch, with Quick-Connect Coupling Adapters (for Non-Potable Water Service)

1. Hose valves shall have brass body, pressure rating of at least 125 psi cold water, 3/4-inch NPT female inlet, 3/4-inch male hose thread outlet, lock shield bonnet, and removable handle. Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Provide with quick-connect female adapter to fit the quick-connect male adapter on the rubber water hose. Products: Acorn 8126 surface pipe mounted valve with bent nose without flange; Acorn 8121 mount through wall valve with bent nose with flange; Acorn 8131 pipe and pedestal-mounted valve located above 6 inches, straight nose; Acorn 8136 pedestal-mounted valve located lower than 6 inches, inverted nose; or approved equal.

G. Type 730—Bronze Needle Valves, 3/4 Inch and Smaller

1. Needle valves shall be all bronze (ASTM B61, ASTM B62, or ASTM B584, Alloy C83600) with screwed ends, screwed bonnet, and rising stem. Valves shall have a pressure rating of at least 400 psi at a temperature of 150°F. Stems shall be bronze: ASTM B98/B98M (Alloy C65100), ASTM B150/B150M (Alloy C64200), ASTM B584 (Alloy C87600), or ASTM B371/B371M (Alloy C69400). Valves shall be Stockham B-64, Crane No. 88, or approved equal.

H. Type 750—Brass Angle Valves for Use in Fire Protection Service

1. Valves for use at fire hose racks shall be nominal 1-1/2 inches, with female NPT inlet and outlet. Valves shall be UL listed and FM rated for fire protection service. Valves shall be constructed of brass with an iron handwheel painted red. Valves shall be rated for at least 300 psi working pressure. Valves shall be Potter-Roemer Figure 4070, Allenco Figure 171, or equal.

I. Type 760—Bronze Angle Valves, 2 Inches and Smaller

1. Angle valves, 2 inches and smaller, shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with screwed ends, union or screwed bonnet, inside screw, rising stem, and bronze disc. Valves shall have a pressure rating of at least 200 psi. Stems shall be bronze: ASTM B371/B371M (Alloy C69400 or C69700). Valves shall be Stockham B-222T Lunkenheimer Figure 2141 or approved equal.

2.16 PINCH (TYPE 800 SERIES)

A. Type 800—Pinch Valves, 1 Inch through 8 Inches

1. Pinch valves 1 inch through 8 inches shall have cast-iron (ASTM A48/A48M, Class 30) bodies with totally enclosed actuators. Sleeves shall be neoprene, Buna-N, or Hypalon. Ends shall be flanged, ASME B16.1, Class 125. Valves shall be handwheel operated with upper and lower pinch bars. Valves installed on the end of a pipe shall be provided with a Type 304 stainless-steel retaining ring to hold the sleeve end in place. Valves shall be Red Valve Series 75, General Rubber Corporation Flex-Valve Series 2100, or equal.

2.17 PLUG (TYPE 900 SERIES)

A. Plug and Seating Design for Eccentric Plug Valves (Types 900, 910, and 920): Eccentric plug valves shall comply with MSS SP-108 and the following. Provide a rectangular or circular plug design, with an associated rectangular or round seat. Provide bidirectional seating design. The valve shall seat with the rated pressure upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.

B. For Types 900, 910, and 920 eccentric plug valves, the metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs which result in a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Nowhere in the valve or actuators shall the valve shaft be exposed to iron-on-iron contact. Sleeve bearings shall be stainless-steel in valve sizes 20 inches and smaller and bronze or stainless-steel in valve sizes 24 inches and larger. Provide enclosed worm-gear actuators for valves 6 inches and larger.

C. Rubber compounds shall have less than 2% volume increase when tested in accordance with ASTM D471 after being immersed in distilled water at a temperature of 73.4°F ±2°F for 70 hours.

D. Type 900—Eccentric Plug Valves, 3 Inches and Smaller

1. Eccentric plug valves, 1/2 inch through 3 inches, shall be non-lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be made of cast-iron in accordance with ASTM A126, Class B. Ends shall be threaded or flanged (ASME B16.1, Class 125). Plugs shall be stainless-steel or cast-

iron (ASTM A126, Class B) with Buna-N coating. Body capscrews and bolts and nuts shall be Type 316 stainless-steel. Packing shall be nitrile butadiene-filled PTFE. Provide 100% port area. Valves shall be DeZurik PEF, Clow F-5412, Val-Matic "Cam-Centric," Milliken "Millcentric" Figure 601, Pratt "Ballcentric," or approved equal.

E. Type 902—Eccentric Plug Valves, 4 Inches through 12 Inches

1. Eccentric plug valves 4 inches through 12 inches shall be non-lubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be cast-iron in accordance with ASTM A126, Class B. Ends shall be flanged, Class 125 in accordance with ASME B16.1. Plugs shall be stainless-steel, cast-iron (ASTM A126, Class B), or ductile-iron (ASTM A536, Grade 65-45-12) with Buna-N facing. Valve body seats shall be Type 304 or 316 stainless-steel or have a raised welded-in overlay at least 1/8-inch thick of not less than 90% nickel. Body capscrews and bolts and nuts shall be Type 316 stainless-steel. Packing shall be butadiene-filled Teflon. Provide 100% port area. Valves shall be DeZurik PEF, Clow F-5412, Val-Matic "Cam-Centric," Milliken "Millcentric" Figure 601, Pratt "Ballcentric," or approved equal.

F. Type 910—Cast-Iron Non-Lubricated Eccentric Plug Valves, 3 Inches and Smaller

1. Plug valves 3 inches and smaller shall be non-lubricated eccentric type, cast-iron body, screwed end connection, resilient plug, stainless-steel bearing, and O-ring seals, as manufactured by Dezurik Water Controls, Bulletin 1200-18, or an approved equal.

G. Type 920—Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger

1. Plug valves 4 inches and larger shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with flanges or mechanical-joint end connections to match connecting piping and as shown in the Drawings. Flanged valves shall be 125-pound flanges and faced and drilled to the ASME B16.1, 125-pound standard. Mechanical joint ends shall conform to AWWA C111/A21.11. Valve bodies shall be of ASTM A126 Class B cast-iron. Valves shall be furnished with a welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in

the field with the valve in the line under pressure. Plugs shall be resilient faced with Hycar (Acrylonitrile-Butadiene) or Buna N, formulated and constructed to be suitable for use with wastewater. Minimum port areas shall be 80% of full pipe flow area. Valves shall have sleeve-type metal bearings and shall be of sintered, oil-impregnated, permanently lubricated Type 316 ASTM. Nonmetallic bearings shall not be acceptable. Valve shaft seals shall be of the multiple V-ring type or U-cup type and shall be externally adjustable and replaceable without removing the bonnet or actuator from the valve under pressure. Valves using O-ring seals or non-adjustable packing shall not be acceptable. All exposed nuts, bolts, springs, washers, and other fasteners shall be 300-series stainless-steel. Valve working pressure ratings shall be a minimum of 150 psi. Each valve shall be given a hydrostatic and seat test with certified copies of proof-of-design test reports as outlined in AWWA C504, Section 5.5. Plug valves shall be DeZurik PEC Series, Henry Pratt Company “Ballcentric” Series, or approved equal.

2.18 SOLENOID VALVES (TYPE 1000 SERIES)

Design and construct solenoid valves so that they can be used in horizontal and in vertical piping.

A. Type 1000—Metallic Solenoid Valves, 1-1/2 Inches and Smaller

1. Solenoid valves 1/4 inch through 1-1/2 inches for water and air service shall have forged brass (Alloy C23000) or bronze (ASTM B62) bodies with Teflon main seats. Internal plunger, core tube, plunger spring, and cage assembly shall be stainless-steel (Types 302, 304, or 305). Solenoid enclosures shall be NEMA 4**,** except where explosion-proof is noted in the Drawings. Valve actuators shall be 120-volt a-c. Seals shall be Teflon. Valves shall have a maximum operating pressure and a maximum differential pressure of 125 psi. Solenoid valves shall be energized to close. Valves shall be ASCO "Redhat", Parker Hannifin “Skinner”, or approved equal.

2.19 OTHER SPECIAL TYPES OF VALVES (TYPE 1100)

A. Type 1130—PVC Vacuum Breaker Valves, 1 Inch and Smaller

1. Vacuum breaker valves shall have PVC body and EPDM diaphragm and seals. The diaphragm shall unseat at 2-inch Hg vacuum and allow air to enter the system at 80 scfm. End shall be threaded or socket-welded according to the Drawings. Vacuum breaker valve shall be Plast-O-Matic

Series VBM, Ryan Herco, Harrington Industrial Plastics, or approved equal.

B. Type 1140—Atmospheric Vacuum Breakers

1. Vacuum breaker valves shall allow air to enter the line if pressure loss causes vacuum conditions. The air inlet shall close without spillage upon initial application of line pressure. The body shall be brass UNS C46400. Poppet or ball shall be plastic suitable for service in methanol or AISI Type 440 stainless-steel. The seat shall be Buna-N. Valves shall be Febco Model 710, Kadant Johnson Series VB8, Wilkins Division of Zurn Industries, or approved equal.

C. Type 1180—Gauge Valves

1. Gauge valves shall be a combination isolation and vent valve with a minimum pressure rating of 3,000 psi at 200°F. Isolation valve shall have interchangeable hard or soft seat. Body, bonnet, and stem shall be Type 316 stainless-steel. Packing shall be PTFE or Buna-N. Valves shall have screwed ends and nonblowout stems. Valves shall be ARCO Engineering, Inc. Anderson Greenwood M9 Series or approved equal.

D. Type 1185—Gauge with Annular Diaphragm Seal:

1. Annular diaphragm seal and pressure gauge assemblies shall be provided at locations listed below or as shown in the Drawings. All annular diaphragm seal pressure gauge assemblies shall include an ethylene-glycol factory-liquid-filled pressure gauge and an annular seal assembly shall consist of a Buna-N diaphragm annular seal sleeve, carbon-steel body, and ASME B16.5 Class 150 full-faced flanges (through bolted configuration). Pressure gauges shall be constructed with a stainless-steel case with pressure ranges listed below. Annular diaphragm seal and pressure gauge assemblies shall be as manufactured by the Red Valve Company, Incorporated, Series 48; or approved equal.
2. Furnish and install annular seal and pressure gauge assemblies as shown on the Drawings.

E. Type 1195—Back-Pressure Valves 1 Inch and Smaller (for sample line pressure control use at analyzer sample point at specific locations shown on the Drawings)

1. Back-pressure valves 1 inch and smaller for low-pressure applications shall be of all bronze body construction with threaded-end connections, brass body seat, Neoprene-Nylon diaphragm, and composition disc, with sensitive adjustment spring for control of valve inlet (line) pressures up to

25 psig. The Contractor shall insert a tee upstream of back-pressure valve and a sensing line routed from tee to the top of back-pressure valve as recommended by the valve manufacturer. Valves shall be as manufactured by Cash-Acme, Type DR-A, or approved equal.

F. Type 1196—Back-Pressure Valves 2 Inches and Smaller (for sample pump discharge line pressure control use at specific locations shown on the Drawings)

1. Back-pressure valves 2 inches and smaller shall be of all bronze body construction with threaded-end connections, brass body seat, 303 stainless-steel seat ring and disc, Buna-N diaphragm, and Buna-N O-ring. Valves shall be rated for 250 psi and 200°F and shall be as manufactured by Cash-Acme, Type FR-10, or approved equal.

PART 3 EXECUTION

3.01 JOINTS

A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. 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.

C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).

D. Install grooved-end couplings for valves in accordance with Section 15055, Piping Systems—General.

3.02 INSTALLING EXPOSED VALVES

A. Unless otherwise indicated in the Drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.

B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

3.03 INSTALLING BURIED VALVES

A. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement as required on the Drawings, and place and compact the backfill to the height of the valve stem.

B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.

C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.

D. In streets without concrete curbs and in open areas, install the valve box as for a paved area with concrete curb but include a marker post. Cut the marker post from 4-inch-by-4-inch dense structural grade Douglas fir No. 2 or Southern Pine No. 2 surfaced on four sides to a length of 5 feet. Chamfer the top. Set the post in concrete, 2 feet into the ground, away from traffic, and to the side of the pipeline. Coat with a seal and finish coat of white alkyd exterior paint. On the side facing the valve, letter in black the word “VALVE” and the distance in feet from the marker post to the valve box cap.

E. Install debris cap as close as possible under the cast-iron cover without interfering with the cover operation. Trim flexible skirt to provide a smooth contact with the interior or the extension pipe.

3.04 INSTALLING EXTENSION STEM GUIDE BRACKETS

A. Install extension stem guide brackets at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

3.05 FIELD COATING BURIED VALVES

A. Coat flanges of buried valves and the flanges of the adjacent piping and the bolts and nuts of flanges and mechanical joints, as specified in Section 09900, Painting and Coating.

B. Wrap buried metal valves 6 inches and larger with polyethylene sheet as specified in Section 15155, Ductile Iron Pipe and Fittings.

3.06 VALVE LEAKAGE AND FIELD TESTING

A. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15144, Pressure Testing of Piping, for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.

B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind or do not operate from full open to full closed, repair or replace the valve and repeat the tests.

C. Test gear actuators through three full cycles from full-open to full-close without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 foot-pounds. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Operators shall be lubricated in accordance with the manufacturer's recommendations before operating.

WATER SERVICE CARD

Date of Installation _____

Contract Drawing Number_____

Service Line Size (inches) _____
Length of Water Service Line (feet) _____
Meter Size (inches) _____

Name _____
House/Business Address or Location:

_____
_____
_____

Phone # _____

GPS coordinate @ main _____
GPS coordinate @ meter _____
Confirm Photos are attached _____

Installation Foreman _____

Service Layout

Provide a brief sketch of the installed configuration. Indicate lengths, depths of the water service, and show three ties to meter box and to corporation stop:

Depth @ Main (feet) _____
Depth @ stub out (feet) _____

_____ _____
Contractor Signature Resident Observer Signature

(Rev 2 – 15 Oct 2006)

ISOLATION VALVE CARD

Date of Installation _____

Contract Drawing Number _____

Closest Street Address to Valve or Location of Valve

_____

_____

_____

Size of Valve (inches) _____

Circle Type of Valve: Gate Butterfly

GPS Coordinate @ Valve _____

Installation Foreman _____

Confirm Photos are attached _____

Isolation Valve Layout

Provide a brief sketch of the installed configuration. Show depths of the water line and show three ties to the isolation valve:

Depth @ Main (feet) _____

_____ _____

Contractor Signature Resident Observer Signature

(Rev 2 – 15 Oct 2006)

FIRE HYDRANT CARD

Date of Installation _____

Contract Drawing Number _____

Closest Street Address to Fire Hydrant or Location of Fire Hydrant

_____
_____
_____

Length of Hydrant Line (feet) _____

List any offset fittings required. _____

List Utilities requiring offset fittings _____

GPS coordinate @ main _____
GPS coordinate @ Hydrant _____
Installation Foreman _____

Confirm Photos are attached _____

Fire Hydrant Layout

Provide a brief sketch of the installed configuration. Indicate lengths, depths of the water line and hydrant, offset fittings, and show three ties to the fire hydrant isolation valve:

Depth @ Main (feet) _____
Depth @ hydrant (feet) _____

_____ _____
Contractor Signature Resident Observer Signature

(Rev 2 – 15 Oct 2006)

END OF SECTION

SECTION 15119
ELECTRIC MOTOR ACTUATORS FOR GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required to install complete and ready for operation electric motor-actuated gate assemblies shown in the Drawings and as specified in this Section. The electric motor-actuated gate assemblies shall consist of gates specified elsewhere with electric motor multi-turn actuators with stem-mounted worm-gear actuators for exposed gear boxes, yoke, pedestal, or operator housing for gate actuation service; extension stems and extension bonnets with worm-gear actuators for buried valve actuation service; controls for local and remote operation; and accessories required for manual and automatic gate operation.

B. All gate and actuator combinations of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

C. Gates (Fabricated Slide or Sluice Gates) shall be as specified in Section 15065, Fabricated Gates. The complete electric motor-actuated gate assemblies shall be assembled at the gate factory for performance testing. The completed assemblies for each gate shall be shipped to the job site ready for installation including actuator, actuator controls, gate with mechanical worm-gear actuator, and extension stem assemblies as required.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with the requirements of Section 01330, Submittals and Acceptance.

B. The Contractor shall submit the following:

1. Actuator manufacturer’s catalog data showing motor actuator parts and materials of construction, referenced by AISI, ASTM, SAE, or CDA specification and grade. Indicate motor actuator dimensions, weights, and coatings.
2. The maximum torque required to open and close each motor-actuated gate supplied for this project.
3. Certified factory performance test records for each assembly.
4. Motor data including nameplate data, insulation type, duty rating, and torque output at duty rating.

5. Electrical schematic drawings and interconnecting wiring diagrams for external monitoring and controls.
6. Catalog data, brochures, drawings for gates, worm-gear actuators, bonnet extensions, shaft extensions, and other accessories.
7. Catalog data, drawings, diagrams for the complete assembly including drawings of each assembly, and dimensions of extension bonnets from the center line of the gate to the center line of the electric motor actuator.
8. Control descriptions for local and remote controls including opening and closing (speed) times and gate positions for open/close control duties. Control requirements are described in other sections and elsewhere in the Contract Documents.
9. Site storage, protection, and installation requirements and procedures.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

B. American Iron and Steel Institute (AISI

A. American Water Works Association (AWWA)

1. AWWA C540—Standard for Power-Actuating Devices for Valves and Slide Gates.

B. Society for Automotive Engineers (SAE)

C. National Electronic Manufacturers Association (NEMA)

1. NEMA 4X—Electronic Component Enclosures.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling and Section 15065, Fabricated Gates, for the items specified in this Section.

1.06 QUALIFICATIONS

A. All electric motor-actuated gate assemblies shall be products of well-established gate manufacturers, which are fully experienced, reputable, and have been furnishing electric motor-actuated gate assemblies including field servicing and start-up for a minimum of 10 years. The gates shall be designed, constructed, and installed in accordance with the requirements and procedures of AWWA C540 and other applicable AWWA standards and shall comply with these Specifications as applicable.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. All electric motor-actuated gate assemblies shall be furnished with all necessary operating appurtenances that are required for the proper completion of the work specified in this Section and as specified in Section 15065, Fabricated Gates, as applicable, including but not limited to:

1. Gate-Stem and Extension Bonnet Mounted Worm-Gear Type Actuators.
2. Extension Stems.
3. Actuator Support Floor Stands (if required).
4. Extension Bonnets.
5. Electric Motor Actuator Mounted to Worm-Gear Actuators for gear boxes, yoke, pedestal, or operator housing for gates with Manual Handwheel Operator and Local Control.

B. Electric motor-actuated gate assemblies designated to be furnished with bonnet extensions shall have bonnet extensions and shaft extensions lengths to provide the electric motor actuator centerline at 48 inches above the concrete maintenance slab or frame, as shown in the Contract Drawings.

2.01 GATES

A. Motorized slide or sluice gates are identified in the Drawing by size, type, and number in the Gate Schedule and elsewhere in the Drawings.

2.02 ELECTRIC MOTOR ACTUATOR

A. Acceptable Electric Motor Actuator Manufacturer:

1. Rotork Controls IQ Series (Open/Close).
2. Or approved equal.

B. Process Identification Numbers

1. Gates:

a. Motor Actuator – Transfer Pump Station Pond Pipe No. 1: CC-SG-1.
b. Motor Actuator – Transfer Pump Station Pond Pipe No. 2: CC-SG-2.

C. The actuators shall be electric motor gear train type consisting of motor controls, gearbox, geared limit switches, torque switches, and a manual override handwheel with a declutching lever and worm-gear actuator suitable for multi-turn gate operation. The actuators shall be of the self-locking type and shall operate the gate from fully opened to fully closed positions or the reverse in approximately 60 seconds or less.

D. Actuator Torque Requirements

1. The rated output torque of the motor actuator shall be at least 1.5 times the maximum torque required to open or close the gate at any position including seating and unseating conditions when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the gate assembly. Do not include hammer-blow effect in sizing the actuator to comply with this torque requirement. The Contractor shall coordinate with the gate manufacturers to ensure that the motor actuators stall torque output does not exceed the torque limits of the gate operating stem or shaft.
2. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure or head across the gate is equal to the pressure or head rating of the gate.
3. Gates: Assume a maximum pipeline fluid velocity of 10 feet per second (fps) with the gate fully open unless a higher velocity is specified in the detailed gate specification section.

E. Actuator Service Conditions

1. The electric motor gate actuators shall be sized for the following service conditions:

Gate Location/Designation	Gate Dimensions (inches)	Maximum Flow (gpm)	Maximum Differential Level (feet)	Duty Function	Extension Bonnet Required
Transfer Pump Station Pond Pipe No 1: CC-SG-1	2'-0" x 2'-0"	1,560	6	Open/Close	Yes
Transfer Pump Station Pond Pipe No. 2: CC-SG-2	2'-0" x 2'-0"	1,560	6	Open/Close	Yes

F. Design of Electrical Motor Actuators

1. The actuators shall comply with AWWA C540, except as modified herein. Output capacity of motors shall be sufficient to open or close the gate against the maximum differential pressure or head when the voltage is 10% above or below normal at the specified service conditions. Motors shall have a Class F or H insulation system. Provide the motor with torque output (at duty rating) that exceeds the requirements of the following paragraphs including the safety factor.

2. Design the actuator to move gates from fully closed to fully open in the time specified in the subsection on "Service Conditions."

3. Provide the following integral to the actuator: reversing, magnetic starter, three overloads (one in each ungrounded leg) or two motor thermal cutouts, 120-volt control power transformer, LOCAL/STOP/REMOTE selector switch (maintained), OPEN-STOP-CLOSE selector switch (spring return to center), and OPEN/CLOSED status indicator lights.

4. Provide dry contact for remote indication of the actuator status and alarm conditions as follows:

   a. Mode of operation (LOCAL/REMOTE).
   b. Actuator FAIL.
   c. Gate FAIL.
   d. OPEN/CLOSE Status.

5. The actuator shall operate (i.e., move full open or full closed) upon receipt of a remote contact. The actuator operation shall be mutually exclusive

(i.e., operate only upon receipt of a remote OPEN or remote CLOSED command).

6. The actuator shall include provisions for Emergency Shutdown (ESD) operation, initiated by a remote contact. ESD operation shall maintain the existing gate position or position the gate full OPEN or full CLOSED, as preconfigured. This command shall override any command, local or remote.

7. Establish an Actuator FAIL alarm whenever any of the following conditions are active, as a minimum:

    a. Battery LOW.
    b. Loss of Power.
    c. HIGH Motor Temp.

8. Establish a Gate FAIL Alarm whenever any of the following conditions are active, as a minimum:

    a. Gate Jammed (High torque on stops).
    b. Gate Stalled (High torque off stops).

9. Provide a separate (remote) enclosure with local/remote selector switch, stop-open-close push buttons, and open and closed indicator lights for motor actuators over 6 feet 6 inches above the floor or deck in lieu of integral controls.

10. Do not use external conduit for wiring any components within the actuator.

11. Gear actuators shall be totally enclosed and factory-grease packed or oil lubricated. The power gearing shall consist of helical gears of heat-treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm shall be hardened steel alloy. Design gears for 24-hour continuous service with an AGMA rating of 1.50.

12. Position switches shall be integrally geared to the actuator and shall be adjustable and capable of actuation at any point between fully opened and fully closed positions. The position switches shall operate while the actuator is either in manual or in motor operation. Provide motor actuators with position switches capable of being separately used to provide remote indication of end of travel in each direction and to stop motion at the end of travel in each direction.

13. Provide two individually adjustable torque switches to protect the gate and motor against overload in the opening and closing directions. To prevent hammering, the torque switch shall not reclose until the gate is made to travel in the opposite direction.

14. Provide a manually operated handwheel that shall not rotate during electrical operation. If electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the gate is operated manually, the motor shall not rotate. After electrical power is restored, the handwheel shall automatically disengage. Design the handwheel diameter so that hand operation will not damage the gate and is of sufficient size and orientation to provide ease of use and access.

15. The position switch and torque switch contacts shall be capable of interrupting at least 0.2-ampere inductive load at 125-V d-c or 6-ampere inductive load at 120-VAC.

16. Provide a lost-motion device for open/close operation to permit the motor to reach full speed before the load is applied. Provide lost-motion action for manual operation also. Do not provide lost-motion device for modulating applications.

17. Provide a minimum 10-watt space heater mounted in the actuator housing to prevent condensation and maintain the temperature in the actuator housing 5° above the ambient temperature in the structure. Heater shall be on at all times.

18. The motor shall de-energize if a stall occurs when attempting to unseat a jammed gate.

19. Provide a time delay to prevent instant reversal of the actuator motor.

20. Provide terminal connections for external remote controls fed from an internal 24-volt or 120-volt supply.

21. Provide a main disconnect NEMA 4X SS rated 15-ampere three-pole, 480-volt non-fused to be mounted on the gate assembly.

PART 3 EXECUTION

3.01 STORAGE AND/OR INCOMPLETE INSTALLATION BEFORE START-UP

A. Electric motor-actuated gate assemblies delivered to the site, stored, and/or installed outside exposed to the weather or temperatures below 40°F before

permanent installation and start-up, shall be protected according to the actuator manufacturer's recommended procedures for exposure and extended storage.

3.02 FACTORY ASSEMBLY

A. Factory mount the electric motor actuator and controls on the worm-gear gate operator extension bonnet with the extension stem to gate and furnish and transport the completely assembled electric motor-actuated gate assembly to the site.

3.03 FACTORY ADJUSTMENTS AND TESTS

A. The gate manufacturers shall mount and adjust the electric motor actuator and accessories on each gate and operate each electric motor-actuated gate assembly before shipment. Adjust the limit switch position and torque switches. Measure and record the motor current at the maximum torque tripping point and actuator output speed.

3.04 PAINTING AND COATING

A. Coating system shall be one of the following:

1. Coat electric motor actuator in the factory with the manufacturer's recommended coating system for the service conditions described below. Corrosive applications indicated below by the suffix "H" following the actuator type designation shall require a special chemical corrosion resistant coating that is recommended for the application. The manufacturer's standard factory coatings shall be considered acceptable if the manufacturer submits a certification letter stating that the coating is recommended for the specific chemical service as indicated below or sufficiently demonstrates that the chemical resistance of the coating using chemical resistance tables or literature cut sheets provided by the coating manufacturer.
2. Coat ferrous metallic components of the actuator in the factory with a prime coat in accordance with Section 09900, Painting and Coating, System No. 11 for ferrous metals. The Contractor shall apply the intermediate and finish coats for System No. 11, Section 09900, Painting and Coating, in the field.
3. Do not coat non-ferrous metallic components of the actuator in the factory. Instead, the Contractor shall apply prime coat using System No. 51, Section 09900, Painting and Coating, followed by the intermediate and finish coats of System No. 11, Section 09900, Painting and Coating, in the field.

4. The Contractor shall be allowed to overcoat the actuator factory coatings with System No. 11, Section 09900, Painting and Coating, intermediate and finish coats to meet the corrosion resistance requirement if the System No. 11 coating manufacturer provides written certification that System No. 11 intermediate and finish coats are compatible with the actuator factory coating.
5. Thermoplastic components with UV inhibitors shall be considered corrosion resistant and shall not require additional coatings.

3.05 FIELD INSTALLATION

A. Install the electric motor actuator gate assemblies in accordance with the manufacturer's instructions. Keep assemblies dry, closed, and sealed to prevent internal moisture damage during construction. Electric motor actuator gate assemblies shall not be stored or placed in direct contact with the ground before installation. Provide additional hangers and supports for assemblies to prevent eccentric loads bearing on the gate.

3.06 FIELD TESTING

A. Testing shall simulate a typical gate load. Test motor actuators and record the following:

1. Current at maximum torque setting.
2. Torque at maximum torque setting.
3. Flash test voltage.
4. Actuator output speed and open to closed and closed to open operating times.

B. Test motor actuators as installed by measuring the current drawn (in amperes) by each motor for unseating, seating, and running conditions. The measured current shall not exceed the current measurement recorded during the factory performance test.

C. If the measured current drawn exceeds the factory performance test value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the factory value.

D. Ensure that limit switches are placed at their correct settings. Open and close gates at least twice to demonstrate to the Owner and Engineer and to ensure that the gear actuator and associated limit switches are properly set and are functioning properly to fully close and fully open the gate while under working service pressure. Confirm proper setting of limit switches as noted above to

prevent premature protective shear pin failure in the open and close modes while operating under working service conditions.

E. Provide a performance test certificate with results of the tests stated above. In addition, include details of this specification including gear ratios for both manual and automatic drive, closing direction, wiring diagram code number, and all other field test measurements.

3.07 FIELD SERVICE

A. The Contractor shall provide the services of the electric motor actuator gate assembly manufacturer's representatives for the electric motor actuator gate assemblies specified herein in accordance with Table 11000-1, Equipment Testing Requirements, in Article 3.04, Manufacturer's Certification of Compliance, of Section 11000, General Equipment Requirements.

3.08 CERTIFICATION

A. Provide written certification from the electric motor actuator gate assembly supplier that the assemblies have been properly installed and factory and field tested in accordance with Section 11000, General Equipment Requirements. Make all necessary corrections and adjustments including but not limited to parts, labor, or freight at no additional cost to the Owner.

END OF SECTION

SECTION 15121
MISCELLANEOUS PIPE FITTINGS AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes requirements for materials and installation of miscellaneous piping specialties, such as quick-connect couplings and pre-filters for the sodium hypochlorite system.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit manufacturer's catalog data and descriptive literature showing dimensions and materials of construction by ASTM reference and grade. Show coatings.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI C1012—Specification for Hard-Drawn Low-Carbon Steel.

B. American Society for Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
2. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A513/A513M—Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM A635/A635M—Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.

6. ASTM C219—Standard Terminology Relating to Hydraulic Cement.
7. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.

C. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
2. ASME SA36—Carbon Steel Shapes, Plates, and Bars of Structural Quality for Use in Riveted, Bolted, or Welded Construction of Bridges and Buildings, and for General Structural Purposes.
3. ASME SA675—Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

D. American Water Works Association (AWWA)

1. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
2. AWWA C213—Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
3. AWWA C219—Bolted Sleeve-Type Couplings for Plain-End Pipe.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

PART 2 PRODUCTS

2.01 METALLIC QUICK-CONNECT COUPLINGS

A. Type 6: Quick-connect couplers shall be female-coupler/female-thread type with locking handles. Provide dust plug and security chain with each coupler. Bodies and locking handles shall be Type 316 stainless steel. The gasket shall be Teflon. Couplers shall be CIVACON Kamlok 633-D/634-A, Evertite Part D/DP, or equal.

B. Type 8: Quick-connect couplers shall be male-adapter/female-thread type. Provide dust cap and security chain with each coupler. Bodies and locking

handles shall be Type 316 stainless steel. The gasket shall be Teflon. Adapters shall be CIVACON Kamlock 633-A/634-B, Evertite Part A/DC, or equal.

C. Type 10: Quick-connect couplers shall be male-adapter/hose-shank type. Provide dust cap with each coupler. Bodies and dust caps shall be Type 316 stainless steel. The gasket shall be Teflon. Adapters shall be CIVACON Kamlok 633-E/634-B, Evertite Part C/DC, or equal.

2.02 NON METALLIC QUICK-CONNECT COUPLINGS

A. Type 6A: Quick-connect couplers shall be female-coupler/female-thread type with locking handles. The Contractor shall provide a dust plug and security chain with each coupler. Bodies shall be glass-fiber-reinforced polypropylene. Locking handles shall be stainless steel. The gasket shall be Teflon. Couplers shall be Evertite Part D/DP, Banjo Corporation Female Cplg/Female Thread and Dust Plug, Murray Equipment Inc. Style D/DP, or equal.

B. Type 8A: Quick-connect couplers shall be male-adapter/female-thread type. Provide dust cap and security chain with each coupler. Bodies shall be glass-fiber-reinforced polypropylene. Locking handles shall be stainless steel. The gasket shall be Teflon. Adapters shall be Evertite Part A/DC, Banjo Corporation Male Adapter/Female Thread and Dust Cap, Murray Equipment Inc. Style A/DC, or equal.

C. Type 10A: Quick-connect couplers shall be male-adapter/hose-shank type. Provide dust cap with security chain with each coupler. Bodies shall be glass-fiber-reinforced polypropylene. Locking handles shall be stainless steel. The gasket shall be Teflon. Adapters shall be Evertite Part C/DC, Banjo Corporation Male Adapter/Hose Shank and Dust Cap, Murray Equipment Inc. Style E, or equal.

2.03 COUPLINGS FOR METALLIC PIPING

A. General

1. Thrust Ties: The Contractor shall provide thrust ties where shown and where required to restrain the force developed by 12 times the maximum operating pressure specified.

    a. Steel Pipe: Attach with fabricated lugs.
    b. Ductile Iron Pipe: Attach with bell hanger and wedge restraint glands for buried mechanical joint and push-on joint piping; and thrust retention plates and tie-rods, nuts, washers, and bolts for exposed, flanged piping.

2. Exposed Installations: Zinc-plated nuts and bolts. High-strength, low-alloy steel, in accordance with AWWA C111/A21.11, may be substituted for use on cast-iron and ductile-iron couplings.

3. Buried and Submerged Installations: Provide Type 304 stainless steel tie rods, bolts, and nuts and assemble with an anti-galling compound.

4. Steel Middle Rings and Followers: Fusion-bonded epoxy-lined and coated in accordance with AWWA C213.

5. Restrained couplings or other fittings that use set screws, pointed-end screws to penetrate the outside surface of the pipe for restraint are not acceptable.

B. Flexible Couplings: Coupling shall consist of a steel middle ring or sleeve, two steel or malleable iron flange or follower rings, two wedge-shaped resilient gaskets, and a sufficient number of track-head bolts and nuts.

1. Middle Ring or Sleeve: Steel construction, ASTM A513/A513M, ASTM A635/A635M, or ASME SA675 GR60, fabricated in a true circular section and free of surface defect.

2. Follower Rings or Flanges: Steel construction, AISI C1012 or ASME SA36, fabricated in a true circular section and free of surface defect.

3. Bolts and Nuts: Steel bolt, AWWA C111/A21.11.

4. Gaskets: Grade 27 BUNA-S.

5. Shop Paint: Fusion-bonded epoxy coating.

6. Acceptable Manufacturers:

   a. Dresser Manufacturing Division of Dresser Industries, Inc., Dresser Styles 38 and 138.
   b. Or approved equal.

C. Transition Couplings: Transition Coupling shall consist of a high-strength steel body, two steel or malleable iron flange or follower rings, a wedge shaped resilient gasket, and a sufficient number of follower bolts.

1. Adapter: Steel construction, ASTM A513/A513M, ASTM A635/A635M or ASME SA675 GR60, free of surface defect.

2. Followers: AISI C1012 or ASME SA36.

3. Bolts: AWWA C111/A21.11.

4. Gasket: Grade 27 BUNA-S.

5. Shop Paint: Fusion-bonded epoxy coating.

6. Acceptable Manufacturers:

a. Dresser Manufacturing Division of Dresser Industries, Inc., Dresser Styles 62 and 162.
b. Or approved equal.

D. Flanged Coupling Adapters: Adapters shall consist of a cast-iron or high-strength steel body, two steel or ductile-iron follower rings, a wedge shaped resilient gasket, and a sufficient number of follower bolts.

1. 3- through 12-inch DIP Flange Adapters

a. Adapter: Ductile iron construction, ASTM A536, Grade 65-45-12, free of surface defect. Adapter shall be rated to 200 psi working pressure in accordance with AWWA C219, and -20°F to 212°F.

b. Flanges: Ductile iron construction, ASTM A536, Grade 65-45-12, free of surface defect. Bolt circles and bolt holes shall match those of ASME B16.1 Class 125 flanges.

c. Bolts and nuts: Corrosion-resistant alloy bolts and nuts.

d. Gasket: Grade 27 BUNA-S.

e. Shop paint: fusion-bonded powder epoxy coating.

f. Acceptable Manufacturers:

(1) Dresser Manufacturing Division of Dresser Industries, Inc.; Dresser Style 127.
(2) Or Equal.

2. 14- through 36-inch DIP Flange Adapters

a. Adapter: Steel construction, ASTM A513/A513M, ASTM A635/A635M or ASME SA675 GR60, free of surface defect.

b. Flanges: Steel construction, ASTM A513/A513M, ASTM A635/A635M or ASME SA675 GR60, free of surface defect. Bolt circles and bolt holes shall match those of ASME B16.1 Class 125 flanges.

c. Bolts and nuts: Alloy to AWWA C111/A21.11.

d. Gasket: Grade 27 BUNA-S.

e. Acceptable Manufacturers:

(1) Dresser Manufacturing Division of Dresser Industries, Inc., Dresser Style 128.
(2) Or approved equal.

2.04 BOLTED SPLIT-SLEEVE AND SINGLE-POINT CLOSURE COUPLINGS

A. Bolted, split-sleeve, and single-point closure couplings shall meet the materials and performance conforming to AWWA C219, which shall be used for steel pipe and stainless steel pipe.

B. When the connecting piping is carbon steel, the coupling shall be manufactured from ASTM A36/A36M carbon steel. When the connecting piping is stainless steel, the coupling shall be manufactured from ASTM A240/A240M Type 316/316L stainless steel.

C. The coupling shall be of the split type with a single-point closure coupling. Provide welded restraint rings on the pipe ends for end restraint. As the coupling closes, it shall confine an elastomeric o-ring type gasket on each pipe end to create a radial seal. The axial seal shall be affected at the closure plates as bolts pull the coupling snug round the pipe.

D. The coupling manufacturer shall provide the restraint rings for each coupling. The Contractor's fabricator shall weld the restraint rings to the pipe in strict accordance with the coupling manufacturer's recommendations.

E. For water service, the elastomeric O-ring type gaskets shall be EPDM (or other material accepted by the Engineer) conforming to ASTM D2000 for the design pressure for the temperature range of -20°F to 180˚F.

F. Type C201 shall be a shouldered, bolted, split-sleeve, fully restrained coupling. Type C201 coupling shall be Depend-O-Lok F x F (Fixed x Fixed), Type 2 manufactured by Victaulic, Depend-O-Lok, Inc., or approved equal.

G. Type C202 shall be a shouldered, bolted, split-sleeve, fully restrained coupling that allows angular deflection of the connecting pipes. Type C202 coupling shall be Depend-O-Lok F x F (Fixed x Fixed), Type 2, Modified manufactured by Victaulic, Depend-O-Lok, Inc., or approved equal.

PART 3 EXECUTION

3.01 INSTALLING QUICK-CONNECT COUPLINGS

A. Attach to piping in accordance with the relevant piping specification.

3.02 INSTALLING COUPLINGS

A. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15, Mechanical.

B. Alloy steel bolts and nut for flanged joints shall be made with high-strength, low-alloy Cor-Ten bolts, nuts, and washers. Cor-Ten for mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All joints to be wrapped with 8-mil color-coded poly wrap.

C. Before sleeve-type couplings are installed, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.

D. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Set cast-iron box as shown on the Drawings. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box after

installation. Extend tracing wire outside of valve box extension pipe and enter at valve box.

E. Thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket.

F. Wipe gaskets clean before installations.

G. Lubricate flexible couplings and flanged coupling adapter gaskets with soapy water or manufacturer's standard lubricant before installing on the pipe ends.

H. Install couplings, service saddles, and anchor studs in accordance with the manufacturer's instruction.

I. Tighten bolts progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness.

J. Use torque-limiting wrenches to tighten bolts to the manufacturer's specified torque values.

END OF SECTION

SECTION 15122
FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section presents requirements for materials and installation of flexible pipe couplings and expansion joints.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The manufacturer's catalog data on flexible pipe couplings and expansion joints. Show the manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings and joints are used. Show coatings.

B. The manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible sleeve-type pipe couplings.

C. Materials of construction by ASTM reference and grade. Show dimensions.

D. The number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.

B. American Society for Testing and Materials (ASTM)

1. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.

C. American Water Works Association (AWWA)

1. AWWA C219—Bolted Sleeve-Type Couplings for Plain-End Pipe.

D. Expansion Joint Manufacturer's Association (EJMA)

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. Each flexible coupling and expansion joint shall be designed for the type, size, and pressure rating of the connecting piping.

B. All wetted materials shall be suitable for use with the fluid being conveyed.

C. Wetted materials for flexible coupling and expansion joints used to convey drinking water shall be resistant to free chlorine and chloramine concentrations up to 10 mg/L.

D. All flexible couplings and expansion joints used in association with drinking water service shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with NSF 61.

2.02 BOLTED-SLEEVE-TYPE COUPLINGS (TYPE C105)

A. Bolted-sleeve-type couplings shall be designed and manufactured conforming to AWWA C219.

B. Type C105: Flanged Coupling Adapter:

1. Adapters for ductile-iron pipe 12 inches and smaller shall be ductile iron: Dresser Style 127, Smith-Blair Series 912, or equal.
2. Adapters for ductile-iron pipe larger than 12 inches and steel pipe shall be steel: Dresser Style 128, Smith-Blair Type 913, or equal.
3. Flange ends shall match the flange of the connecting pipe.

2.03 BOLTED SPLIT-SLEEVE AND SINGLE-POINT CLOSURE COUPLINGS (TYPE C201 AND C202)

A. Bolted, split-sleeve, and single-point closure couplings shall meet the materials and performance conforming to AWWA C219, which shall be used for steel pipe and stainless steel pipe.

B. When the connecting piping is carbon steel, the coupling shall be manufactured from ASTM A36 carbon steel. When the connecting piping is stainless steel, the coupling shall be manufactured from ASTM A240/A240M Type 316/316L stainless steel.

C. The coupling shall be of the split type with a single-point closure coupling. Provide welded restraint rings on the pipe ends for end restraint. As the coupling closes, it shall confine an elastomeric o-ring type gasket on each pipe end to create a radial seal. The axial seal shall be affected at the closure plates as bolts pull the coupling snug round the pipe.

D. The coupling manufacturer shall provide the restraint rings for each coupling. The Contractor’s fabricator shall weld the restraint rings to the pipe in strict accordance with the coupling manufacturer’s recommendations.

E. For water service, the elastomeric o-ring type gaskets shall be EPDM (or other material accepted by the Engineer) conforming to ASTM D2000 for the design pressure for the temperature range of-20°F to 180˚F.

F. Type C201 shall be a shouldered, bolted, split-sleeve, fully restrained coupling. Type C201 coupling shall be Depend-O-Lok F x F (Fixed x Fixed), Type 2 manufactured by Victaulic, Depend-O-Lok, Inc., or approved equal.

G. Type C202 shall be a shouldered, bolted, split-sleeve, fully-restrained coupling that allows angular deflection of the connecting pipes. Type C202 coupling shall be Depend-O-Lok F x F (Fixed x Fixed), Type 2, Modified, manufactured by Victaulic, Depend-O-Lok, Inc., or approved equal.

2.04 NON-METALLIC BELLOWS EXPANSION JOINTS (TYPE E301 AND E302)

A. Classification:

1. Type E301: Teflon bellows expansion joints.
2. Type E302: Spherical rubber expansion joints.

B. Type E301: Teflon bellows expansion joints:

1. Teflon bellows expansion joints shall be three-convolutions, ductile-iron flanges, Monel reinforcing ring and shall have Teflon facing on the flanges. Provide thrust harnesses. Flanges shall be Class 125, ASME B16.1.
2. Products shall be Peabody-Dore Style E-1608-B, Resistoflex No. R6905, or equal.

C. Type E302: Spherical expansion joints:

1. Spherical design expansion joints shall be chlorobutyl with polyester fiber reinforcing and be provided with steel retaining rings and Type 304 stainless steel gusset plates and control rods. Expansion joints shall have flat-face flanges integral with the body to match Class 125, ASME B16.1.

Joint Size	Flange-to-Flange Length (inches)	Minimum Pressure Rating (150°F), (psi)
4 to 8	6	225
10 to 12	8	225
14 to 20	10 to 12	125

2. Expansion joints shall be manufactured by Metraflex Metrasphere, Proco Series 240, or equal.

2.05 METALLIC BELLOWS FLEXIBLE CONNECTORS (TYPE E600)

A. High-service pump suction and discharge flexible connectors and energy recovery turbine inlet and outlet flexible connectors shall be corrugated-metal bellows-type expansion joints reinforced with equalizing/control rings.

B. Expansion joints shall conform to the Expansion Joint Manufacturers Association (EJMA) standards, latest edition and addenda, in all respects. Bellows elements shall be formed by the hydro-forming process. Expansion joints shall be supplied with equalizing/control rings of the bolted type. Bellows convolutions shall be 2 inches in pitch and height, minimum. All bellows designs shall be provided with bellows calculations that conform to the EJMA standards, including life cycle, and submitted for record purposes. Bellows shall be hydro-tested to 1-1/2 times the design pressure, minimum. The bellows shall not exhibit any signs of squirm. Devices such as flow liners, covers, hinge or gimbal hardware, etc., shall not be used to prevent (or mitigate) the effects of squirm during hydrostatic testing.

C. The expansion joints shall have a design pressure rating of at least 200 psig and shall be furnished with van-stone-type flanged ends with 125-pound drilling.

D. Each expansion joint shall be furnished with an inner flow liner that shall be suitable for conveying potable water at velocities of up to 20 fps in either direction through the expansion joint.

E. Materials of construction shall be as follows:

1.	Bellows:	304 stainless steel
2.	Liner:	304 stainless steel
3.	Equalizing/control rings:	304 stainless steel
4.	Collars/bands:	304 stainless steel
5.	Flange Plates:	Carbon steel

F. Welded stainless-steel components shall be made of low-carbon-type stainless steel.

G. Each expansion joint shall enable a limited gap to be obtained in the flanged joint connections to facilitate pump installation/removal. Each expansion joint shall be designed to provide the following concurrent movements at a minimum:

1.	Compression:	3/4 inch
2.	Lateral offset:	1/8 inch
3.	Angular rotation:	Flange faces parallel within 1/8 inch

H. Expansion joints shall be factory pre-compressed as necessary to facilitate installation. Installed laying length shall be as specified in this Section.

I. Each expansion joint shall be equipped with a tie rod/restraint system designed to limit the axial deflection of the entire flexible connector assembly to no more than 0.005 inch with the piping system subjected to 200-psig pressure. Axial deflection calculations shall be submitted for record purposes. Cotter pins shall be positioned to prevent excessive tie rod nut travel and extension of the flexible connectors beyond their allowable axial movement range. Equalizing/control rings shall prevent excessive compression of the flexible connectors beyond their allowable axial movement range. Double-nutting of the tie rods using jam nuts and heavy hexagonal nuts on/against each side of each plate flange shall lock the position of the connector and prevent tie rod nuts from loosening during system operation, yet allow loosening/re-setting in the event of future pump removal/reinstallation. The tie rod/restraint system shall be reviewed by the high-service pump manufacturer and shall comply with the pump manufacturer's recommendations for the proposed pump/piping configuration.

J. The Contractor shall store, handle, align, and install each expansion joint in conformance with the manufacturer's recommendations.

1. A copy of the manufacturer's installation recommendations shall be provided to the Engineer's site representative or Owner's designated representative at the time of expansion joint installation.
2. The piping and each expansion joint shall be aligned during installation so as to impose no axial, lateral, or torsional deflection. Expansion joints shall not be used to correct piping misalignment. All piping shall be laid true so that expansion joint end fittings mate perfectly with connecting pipe and/or equipment. The Contractor shall demonstrate this alignment to the Engineer's site representative or Owner's designated representative during assembly.
3. All temporary spacers/bracing shall be provided as necessary to provide proper alignment and installation and to maintain the preset compression traverse. Upon completion of the installation, tie rod inner and outer nuts bearing against the faces of each plate flange along with their associated jam nuts shall be positioned/tightened according to the manufacturer's instructions, providing a tied/locked assembly that prevents movement.
4. Each expansion joint shall be installed compressed axially 1/4 inch of the available 3/4 inch; this position shall be the laying length indicated on the Drawings. The provided expansion joints shall be fully compatible with the installation conditions and geometry shown on the Drawings. The expansion joints shall be manufactured by Senior Flexonics, Inc., Expansion Joint Division of New Braunfels, Texas.

2.06 BOLTING FOR FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

A. Bolts and nuts for flexible pipe couplings and expansion joints shall be as specified for the adjacent piping.

PART 3 EXECUTION

3.01 INSTALLING FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installation.

B. Lubricate bolt threads with graphite and oil before installation.

C. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation.

3.02 PAINTING AND COATING

A. Exterior Coating of Buried Flexible Pipe Couplings: Coat buried flexible pipe couplings (including joint harness assemblies) as specified in Section 09900, Painting and Coating. Coat buried bolt threads, tie bolt threads, and nuts according to Section 09900, Painting and Coating.

B. Exterior Coating of Exposed Flexible Pipe Coupling (Non-Submerged): Coat flexible pipe couplings (including joint harness assemblies) located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings according to Section 09900, Painting and Coating. Apply prime coat at the factory.

C. Exterior Coating of Exposed Flexible Pipe Coupling (Submerged): Coat flexible pipe couplings (including joint harness assemblies) that will be submerged according to Section 09900, Painting and Coating. Apply prime coat at the factory.

D. Line carbon steel and iron-flexible pipe couplings according to Section 09900, Painting and Coating.

3.03 HYDROSTATIC TESTING

A. Hydrostatically test flexible pipe couplings and expansion joints in place with the pipe being tested. Test in accordance with Section 15144, Pressure Testing of Piping.

3.04 DISINFECTION

A. Disinfect flexible coupling and expansion joints in place with the adjacent piping according to Section 15141, Disinfection of Piping and Water Storage Facilities.

END OF SECTION

SECTION 15125
PIPING APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all piping appurtenances as shown on the Drawings and as specified in this Section.

B. All piping appurtenances shall be of the size shown on the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

C. All piping appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon the body.

D. The piping appurtenances shall include, but not be limited to, the following:

1. Tapping Saddles
2. Tapping Sleeves and Valves
3. Pressure Gauge Assembly
4. Annular Diaphragm Seal and Pressure Gauge Assembly
5. Fire Hydrant
6. Water Meter
7. Corporation Stop
8. Curb Stop
9. Strainers
10. Emergency Shower/Eyewash and Face/Eyewash Station
11. Double Ball Expansion Joints

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product technical submittal data shall contain the following information and data:

1. Acknowledgment that products submitted meet requirements of standards referenced.

2. Manufacturer’s installation instructions.

3. Expansion joints, flexible joints, couplings, adaptors, tapping sleeves, and other appurtenances:

    a. Pressure and temperature rating.
    b. Materials of construction.
    c. Linings.
    d. Dimensions and weight.
    e. Accessories.
    f. Manufacturer's product brochures, cut-sheets, and parts diagrams.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI Type 304L—Stainless Steel.
2. AISI Type 316—Stainless Steel, Annealed Sheet.

B. American Society for Testing and Materials (ASTM)

1. ASTM A536—Standard Specification for Ductile Iron Castings.
2. ASTM C285—Standard Test Methods for Sieve Analysis of Wet-Milled and Dry-Milled Porcelain Enamel.

C. American Society of Mechanical Engineers (ASME)

1. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standards.

D. American Water Works Association (AWWA)

1. AWWA C105/A21.5—Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA C153/A21.53—Ductile-Iron Compact Fittings.
3. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
4. AWWA C210—Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.

5. AWWA C213—Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
6. AWWA C500—Metal-Seated Gate Valves for Water Supply Service.
7. AWWA C502—Dry-Barrel Fire Hydrants.
8. AWWA C700—Standard for Cold-Water Meters—Displacement Type, Metal Alloy Main Case.
9. AWWA C800—Underground Service Line Valves and Fittings.

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, HANDLING, AND STORAGE

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All piping appurtenances, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall any piping appurtenances be dropped, skidded, or rolled.

C. Slings, hooks, or tongs used for lifting shall be padded to prevent damage to exterior surface or interior linings of piping appurtenances. If any part of the coating, lining, or components is damaged, the Contractor shall make repairs or replacement at his expense and in a manner satisfactory to the Engineer before attempting to install such piping appurtenances.

D. Only new piping appurtenances will be allowed for installation and shall be stored to prevent damage and be kept free of dirt, mud, or other debris.

1.06 QUALIFICATIONS

A. All of the piping appurtenances shall be products of well-established firms that are fully experienced, reputable, have been selling this product for a minimum of 10 years, and qualified in the manufacture of the particular product furnished. The piping appurtenances shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 TAPPING SADDLE

A. See Section 15110, Manual, Check, and Process Valves, for additional information on tapping valves.

B. Saddle body shall be made of malleable iron, ductile iron, or bronze. Malleable iron and ductile iron shall be epoxy or nylon coated. Saddles shall be of the single- or multiple-strap design (multiple straps are required for sizes 10 inches and above). The straps shall be made from Type 304 stainless steel or bronze. The straps shall have a nominal width of 2 inches. Strap studs shall be made from AISI Type 304L stainless steel.

C. Nuts and washers shall be made from Type 304 stainless steel and shall be treated to prevent galling. The straps shall have a curvature accurately formed to meet the diameter of the pipe on which the service saddle is to be installed. A Neoprene gasket shall be securely glued to or imbedded in the body of the clamp to ensure positive sealing against the pipe. Outlet sizes of 3/4 inch and 1 inch shall have female C.C. thread while the outlet for 1-1/2 inches and 2 inches shall be female I.P. thread.

D. Tapping saddles shall not be used on HDPE due to expansion and contraction problems unless specifically approved in writing by the Engineer on a case-by-case basis.

2.02 TAPPING SLEEVES AND VALVES

A. See Section 15110, Manual, Check, and Process Valves, for additional information on tapping valves.

B. Tapping sleeves and valves shall be designed for a minimum water working pressure of 150 psi and shall be tested at 300 psi. The design shall allow for the insertion of bolts from either side and the internal seal is to be the "O-ring" type. The tapping sleeve shall be furnished complete with bolts, nuts, and gaskets.

C. With the exception of the valve ends and other modifications necessary for tapping service, tapping valves shall conform to AWWA C500 and shall be Mueller "No. T-2360" or approved equal. Each tapping valve shall be provided

with a flanged inlet end designed, faced, and drilled for attachment to the outlet flange of the tapping sleeve; an outlet end provided with a tapping flange for attachment of a standard drilling machine; and a mechanical-joint-type bell end for connection of the branch main.

D. Tapping sleeves for 4-inch- through 24-inch-diameter pipe shall be epoxy-coated fabricated-steel construction and manufactured to meet material specification ASTM C285 Grade C for the body. The flange shall conform to AWWA C207 Class D and have an ANSI 150-pound drilling and recessed for tapping valve.

E. Tapping sleeves shall be of the flanged outlet type designed for attachment to the flanged inlet end of the tapping valve and shall be provided with mechanical joint ends at each end of the run. Tapping sleeves shall be Mueller "No. H-615" or approved equal.

2.03 PRESSURE-GAUGE ASSEMBLY

A. Pressure-gauge assemblies shall be provided at locations listed in Article 2.04 of this Section or as shown on the Drawings. All pressure-gauge assemblies shall include a pressure gauge, AISI Type 316 stainless steel, NPT threaded ball valves for isolation and venting, and sensor piping. Sensor piping tubing and fittings shall be Type 316 stainless steel. The pressure gauge shall be constructed of Type 316 stainless-steel wetted parts and Type 304 stainless-steel case and bayonet ring, adjustable pointer, laminated safety-glass window, glycerin liquid-filled case, 1.5% span accuracy, and shall have a 2.5-inch-diameter dial size, minimum. The pressure gauge shall be as manufactured by WIKA Instrument Corporation, Type LM 233.54, or approved equal.

B. The Contractor shall furnish and install pressure-gauge assemblies with pressure-gauge ranges as follows and/or shown on the Drawings.

2.04 ANNULAR DIAPHRAGM SEAL AND PRESSURE GAUGE ASSEMBLY

A. Annular diaphragm seal and pressure gauge assemblies shall be provided at locations listed in this Section or as shown on the Drawings. All annular diaphragm-seal pressure gauge assemblies shall include an ethylene-glycol factory liquid-filled pressure-gauge and an annular seal assembly factory calibrated and ready for field installation. The annular seal assembly shall consist of a Buna-N diaphragm annual seal sleeve, carbon steel body, and ASME B16.5 Class 150 full-faced flanges (through bolted configuration). Pressure gauges shall be constructed with a stainless steel case with pressure ranges listed below. Annular diaphragm seal and pressure-gauge assemblies shall be as manufactured by the Red Valve Company, Incorporated, Series 48, or approved equal.

B. The Contractor shall furnish and install annular seal and pressure-gauge assemblies with pressure gauge ranges as follows and/or shown on the Drawings:

Location	Assemblies per Pump/Blower	Pressure Gauge Range (psi)
Influent Pump Station	1	75
Plant Drain Pumping Station	1	75
BNR Package Plant Blowers	1	25
Digested Sludge Transfer Pumping Station	1	25
Leachate offloading Pump Station	1	25
Leachate Discharge Pumps	1	25
Leachate Blowers	1	25
Transfer Pumps	1	75
Reject Pumps	1	75

2.05 FIRE HYDRANT

A. Fire hydrants shall be in accordance with AWWA C502, for dry barrel-type fire hydrants. Fire hydrants shall meet the following requirements:

Catalogue and maintenance data	Required.
Type of shutoff	Compression or gate.
Size of hydrant (valve opening)	4.5-inch.
Inlet connection	6-inch, verify with drawings.
Outlet nozzles	Two 2.5-inch hose and one 4.5-inch pumper.
Outlet nozzle threads	See Note 1.
Direction to open	Counterclockwise.
Stem seals	O-ring.
Outlet nozzle cap chains	Required.
Drain outlet, non-corrodible	Required.
Traffic breakaway body and valve rod	Required.
Working pressure rating	200 psi (minimum).

Fire hydrant wrenches	Provide five wrenches as spare parts.
Nozzle wrenches	Provide five wrenches as spare parts for each size nozzle provided.
Breakaway repair kit	Provide five kits as spare parts.

Notes

1. Outlet nozzle threads shall be the Owner's standard fire hydrant thread. The Contractor shall verify thread type before submittal.

B. Hydrants shall have Underwriter's Laboratory (UL) and Factory Mutual (FM) approvals. Hydrant exteriors shall be painted with one coat of zinc-chromate alkyd primer and two finish coats of approved paint of the color required by the Owner. Hydrant interiors shall be painted with a paint system approved by NSF for use in potable water. Working parts shall be bronze. All internal parts shall be removable through the top of the hydrant. Hydrants shall conform to NFPA 24.

C. Fire hydrant extensions shall be provided at no additional cost to the Owner to meet final grade requirements. All hydrants shall stand plumb. No portion of the fire hydrant shall be within 6 inches of a sidewalk. After installation, all hydrants shall be inspected, cleaned, and opened and closed as many times as required to verify that all aspects of the hydrant work properly.

D. Fire hydrants shall be M&H, Kennedy, Mueller, American Darling, or equal.

2.06 WATER METER

A. Water meters through 2-inch diameter shall comply with AWWA C700 and NSF 61 standards. The meter housing, bottom plates, and trim shall be bronze. The measuring chamber, disc, strainer, generator housing, register lid, and shroud shall be thermoplastic. The magnet shall be ceramic. The disc and magnet spindles shall be stainless steel. External bolts shall be non-corrosive metal.

B. Water meters shall be rated for continuous operation and have a maximum operating pressure of 150 psi. The measuring element shall be a positive displacement mutating disc. An oscillating piston-type meter is not acceptable. The sealed register shall consist of a straight reading, odometer-type totalizing display with a 10,000,000-gallon capacity (minimum) for meters smaller than the 1.5-inch unit and a 100,000,000-gallon capacity (minimum) for the 1.5-inch meter and larger, 360º test circle with center sweep hand, and flow finder to detect leaks.

All meters shall have rigid, non-ferrous strainers that are easily removable and have an effective straining area of double that of the main-case inlet.

C. The meters shall have the following minimum characteristics:

Meter Size	Minimum Test Flow	Normal Test Flow Limits	Pressure Loss @AWWA Max. Cap.	Laying Length
5/8" x 3/4"	1/4 gpm	1/2 - 20 gpm	5.0 psi	7 1/2"
3/4" x 3/4"	3/8 gpm	3/4 - 30 gpm	7.5 psi	7 1/2" (only)
1"	3/4 gpm	1 1/4 - 50 gpm	7.0 psi	10 3/4"
1 1/2"	1 1/4 gpm	2 1/2 - 100 gpm	7.5 psi	12 5/8" or 13"
2"	1 1/2 gpm	2 1/2 - 160 gpm	9.0 psi	15 1/4" or 17"

D. Water meters shall be Badger Recordall Model, Neptune, or approved equal. Headloss through the meter shall not exceed the published headloss through the named meters at any point on the headloss curve.

E. Water meters larger than 1 inch shall have flanges for inlet and outlet connections; other water meters shall have threaded male inlet and outlet. All meters shall be easily removed from the installed piping.

2.07 CORPORATION STOPS

A. Corporation stops (through 2 inches in diameter) shall be manufactured from cast bronze with machined fitting surfaces and in accordance with AWWA C800. Corporation stops shall withstand a minimum working pressure of 200 psi and be constructed for direct buried service. The inlet and outlet connections shall be coordinated to connect to the adjoining equipment, tubing, piping, couplings, unions, adapters, reducers, etc. by the Contractor. The inlet and outlet size shall be the same. The corporation stop outlet shall have the required all-bronze adapters, unions, reducers, bushings, or couplings to properly secure to the adjacent items and appurtenances. Corporation stops shall be Model FB series as manufactured by Ford Meter Box Company, Inc., or approved equal. Each corporation stop shall be furnished with a solid bronze square-head plug for plugging the corporation stop outlet. Ford stainless-steel insert stiffeners shall be used as required for connection to tubing, PVC pipe, HDPE pipe, or as required.

2.08 CURB STOPS

A. Curb stops shall be manufactured from cast bronze with machined fitting surfaces. Curb stops shall withstand a minimum working pressure of 150 psi. For curb stops (through 2 inches in diameter), the inlet and outlet connections shall be threaded or have 2-hole flanges to connect to the adjoining equipment, tubing,

piping, couplings, unions, adapters, reducers, etc. as coordinated by the Contractor. The nuts and bolts for the flanges shall be cadmium-coated or zinc-plated. The inlet and outlet size shall be the same diameter, unless otherwise approved by the Engineer. The curb stop inlet and outlet shall have the required all-bronze adapters, unions, bushings, or couplings to properly secure it to the adjacent items and appurtenances. Curb stops shall have padlock wings and be lockable with standard size padlocks. Curb stops shall be as manufactured by Ford Meter Box Company, Inc., or approved equal. Each curb stop shall be furnished with a solid bronze square-head plug for plugging the curb stop outlet. Ford stainless steel, insert stiffeners shall be used as required for connection to tubing, PVC pipe, HDPE pipe, or as required.

B. Buried curb stops shall be equipped with a standard cast-iron roadway valve box. The valve box is specified in Section 15110, Manual, Check, and Process Valves.

2.09 STRAINERS

A. Strainers shall be installed where indicated on the Drawings and as specified in this Section. Unless specified otherwise, strainers shall be Y-pattern units with flanged ends and cap, brass or cast-iron body, and stainless steel screens. Screens shall have 40-mesh perforations. Strainers shall be Hayward Industrial Model 80, Hoffman Specialty Model 450, Metraflex Style M1, or approved equal. The blow off from each strainer shall be equipped with a shutoff valve. Blow-down shutoff valves 3/4-inch and smaller shall be provided with male threaded hose adapters. Strainers upstream from double mechanical pump seals shall have 80-mesh screens.

B. A strainer installed in piping immediately upstream from a solenoid valve in water service shall be a Y-pattern unit with brass or bronze body and monel or stainless steel screen. Strainers shall be Cash-Acme Model SY, Hoffman Specialty “Model 420,” or Wright-Austin Model Y, or approved equal. The blow off from each strainer shall be equipped with a shutoff valve.

C. A strainer installed in piping immediately upstream from each 2-inch or smaller pressure-reducing valve shall be a Y-pattern unit with bronze, brass, or cast-iron body and monel or stainless steel screen. Strainers shall be Cash-Acme Model SY, Hoffman Specialty Model 420, Metraflex Style S, or Wright-Austin Model Y, or approved equal. Strainers installed in copper piping shall be of bronze or brass construction. The blow off from each strainer shall be equipped with a shutoff valve.

2.10 EMERGENCY SHOWER/EYEWASH AND FACE/EYEWASH STATION

A. The emergency shower shall be a drench shower with a large stainless-steel arm and pull rod with large, easy-to-find triangle handle. Eyewash shall be activated with a foot treadle for hands-free operation or with a large push flag. The face wash will have an antisurge design and spray ring to wash the entire face. All valves shall stay open until manually closed. The facility must meet current ANSI standards and OSHA requirements. The unit shall be as indicated in the Drawings, a Haws Corporation Model 8300, or approved equal.

2.11 DOUBLE BALL EXPANSION JOINTS

A. Double ball expansion joints shall be installed in the locations indicated on the Drawings and shall be manufactured of 65-45-12 ductile iron conforming to the material requirements of ASTM A536 and AWWA C153/A21.53.

B. Each double ball expansion joint shall be pressure tested before shipment against its own restraint to a minimum of 350 psi (250 psi for flexible expansion joints 30 inches and larger.) A minimum 2:1 safety factor, determined from the published pressure rating, shall apply. Factory Mutual Approval for the 12-inch and smaller sizes is required.

C. Each double ball expansion joint shall consist of an expansion joint designed and cast as an integral part of a ball-and-socket-type flexible joint having a minimum per-ball deflection of: 20°, 3 to 12 inches; 15°, 14 to 36 inches; 12°, 48 inches and 4 inches minimum expansion. Additional expansion sleeves shall be available and easily added or removed at the factory or in the field. The Contractor shall furnish and install double ball expansion joints with mechanical joint or flange end connections to match connecting piping.

D. All internal surfaces (wetted parts) shall be lined with a minimum of 15 mils of fusion-bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be holiday tested with a 1,500-volt spark test conforming to that specification. Sealing gaskets shall be constructed of EPDM. The coating and gaskets shall meet NSF 61.

E. All external surfaces shall be coated with a catalyzed coal tar epoxy conforming to the material requirements of AWWA C210. Appropriately sized polyethylene sleeves meeting AWWA C105/A21.5 shall be included for direct buried applications.

F. Double ball expansion joints shall be FLEX-TEND as manufactured by EBAA Iron Inc. or approved equal.

2.09 SODIUM HYPOCHLORITE (OCL) BAG FILTERS

A. The sodium hypochlorite bag filter body, bag hold-down unit, and restrainer basket shall be constructed of PVC. The cover shall be PVC with a Viton O-ring. Provide the double length bag size filter housing capable of chemical flow rates of 100 gpm with clean filter bags. Inlet, outlet, and drain piping connections shall be 2-inch-diameter true union connections. Provide two 100-micron polypropylene double length filter bags for each filter unit with one serving as a spare. Filter bags shall be Hayward DURAGAF P02E, or equal. Bag filters shall be Hayward Filtration System Polyline Simplex Bag Filter Housing with Double Length Bag Size. Adapters shall be Evertite Part A/DC, Banjo Corporation Male Adapter/ Female Thread and Cap, Murray Equipment Inc. Style A/DC, or equal.

2.12 TOOLS

A. If required for normal operation and maintenance, special tools shall be supplied with the equipment. Two T-handle wrenches to operate standard 2-inch nuts on buried valves and buried valve actuators shall be provided as part of the work.

2.13 PIPE INSULATION AND JACKETING

A. Pipe insulation shall be polyethylene, 1/2-inch minimum thickness, pre- split and self-seal type, sized for each pipe outer diameter, as manufactured by Thermacel, or approved equal.

B. Pipe jacketing shall be white PVC jacketing with self-seal lap, minimum thickness of 0.020 inch and suitable for outdoor installation, sized to cover pipe and polyethylene insulation applied to pipe, as manufactured by Proto, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall install all piping appurtenances as shown on the Drawings.

B. All piping appurtenances shall be installed in the location shown, unless approved otherwise, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Owner and the Engineer.

C. Install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and shall be

responsible for the proper location of these piping appurtenances during the construction of the structures.

3.02 SHOP PAINTING

A. Exterior surfaces of ferrous valves and piping appurtenances shall be painted in accordance with Section 09900, Painting and Coating, unless noted or specified otherwise.

3.03 INSPECTION AND TESTING

A. Completed valves and piping appurtenances shall be subjected to hydrostatic pressure test as described in Section 15055, Piping Systems—General, and the detail pipe sections of these Specifications. All leaks in valves and piping appurtenances shall be repaired and lines retested as approved by the Engineer. Before testing, the valves and pipelines shall be supported and thrust restrained for forces in excess of the test pressure to prevent movement during tests.

END OF SECTION

SECTION 15140
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for domestic water piping inside the building:

1. The Contractor shall provide components and installation capable of producing domestic water piping systems with 60-80 psig, unless otherwise indicated.
2. Section 15145, Domestic Water Piping Specialties, for water distribution piping specialties.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For pipe, tube, fittings, and couplings.
B. Water Samples: Specified in Part 3 *Cleaning* Article.
C. Field quality-control test reports.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM B32—Standard Specification for Solder Metal.
2. ASTM B88—Standard Specification for Seamless Copper Water Tube.
3. ASTM B813—Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
4. ASTM B828—Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
5. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

6. ASTM D2466—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
7. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
8. ASTM D2846/D2846M—Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
9. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
10. ASTM F2014—Standard Specification for Non-Reinforced Extruded Tee Connections for Piping Applications

B. American Society of Mechanical Engineers (ASME)

1. ASME B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22—Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

C. American Water Works Association (AWWA)

1. AWWA C651—Disinfecting Water Mains.

D. Copper Development Association (CDA)

1. Copper Tube Handbook.

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of the specified testing agency.

B. Comply with NSF 61 Sections 1 through 9, for potable domestic water piping and components.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3, *Pipe and Fitting Applications* Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as and with pressure rating at least equal to and ends compatible with the piping to be joined.

2.03 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B88, Types K, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B88, Types L, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.04 CPVC SCHEDULE 80, ASTM D2846/D2846M (CHEMICAL BUILDING ONLY)

1. CPVC Fitting: ASTM D2846/D2846M Schedule 80.
2. Joints: ASTM F493 CPVC cement.

2.05 D.I. WATER PIPE

A. Schedule 40 PVC Pipe: Type I, Grade I PVC 1120 as identified in ASTM D1784.

B. Fitting: Schedule 40 PVC pressure type, ASTM D2466. Solvent weld with ASTM D2564 solvent cement.

2.06 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Section 15110, Manual, Check, and Process Valves.

B. Balancing and drain valves are specified in Section 15145, Domestic Water Piping Specialties.

C. One-piece molded CPVC body, socket ends, 150 psi non-shock cold working pressure. Valve shall be certified by NSF International for use with potable water.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Section 02305, Earthwork for Utilities.

3.02 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

C. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 (DN 100) and Smaller: Soft copper tube, Type K; copper pressure fittings; and soldered joints.

D. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:

1. Hard copper tube, Type L copper pressure fittings, and soldered joints.

3.03 VALVE APPLICATIONS

A. The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball valves for piping NPS 2 (DN 50) and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 (DN 50) and smaller.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. The Contractor shall install the shutoff valve close to the water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures.

C. Install drain valves for equipment at the base of each water riser, at low points in horizontal piping, and where required to drain water piping:

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

3.04 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Section 15050, Basic Mechanical Materials and Methods.

B. Install under-building-slab copper tubing according to CDA's *Copper Tube Handbook.*

C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Section 15050, Basic Mechanical Materials and Methods.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve inside the building at each domestic water service entrance. Pressure

gauges are specified in Section 15125, Piping Appurtenances, and drain valves and strainers are specified in Section 15145, Domestic Water Piping Specialties.

E. Install water-pressure regulators downstream from shutoff valves. Water-pressure regulators are specified in Section 15145, Domestic Water Piping Specialties.

F. Install domestic water piping level without pitch and plumb.

3.05 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Section 15050, Basic Mechanical Materials and Methods.

B. Soldered Joints: Use ASTM B813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B828 procedure, unless otherwise indicated.

C. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.06 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support devices are specified in Section 15060, Pipe Hangers and Supports. The Contractor shall install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Section 15060, Pipe Hangers and Supports.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8-inch.

E. Install hangers for copper piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 and Smaller: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 (DN 40): 120 inches with 3/8-inch rod.

3. NPS 2 (DN 50): 120 inches with 3/8-inch rod.
4. NPS 2-1/2 (DN 65): 120 inches with 1/2-inch rod.

F. Install supports for vertical steel piping every 10 feet.

3.07 CONNECTIONS

A. The Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping next to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water-heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

3.08 FIELD QUALITY CONTROL

A. The Contractor shall inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in the presence of authorities having jurisdiction:

a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspection, the Contractor shall make required corrections and arrange for reinspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. The Contractor shall test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects. If testing is done in segments, submit a separate report for each test, complete with a diagram of a portion of piping tested.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow it to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portions of piping until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.09 ADJUSTING

A. The Contractor shall perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow:

   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. The Contractor shall clean and disinfect potable domestic water piping as follows:

1. Purge water piping.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

b. Fill and isolate system according to either of the following:

(1) Fill the system or part of the system with a water/chlorine solution with at least 50 ppm of chlorine. Isolate the filled portion with valves and allow it to stand for 24 hours.
(2) Fill the system or part of the system with a water/chlorine solution with at least 200 ppm of chlorine. Isolate the filled portion and allow it to stand for 3 hours.

c. Flush the system with clean, potable water until no chlorine is in water coming from system after the standing time.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean the interior of the domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 15141
DISINFECTION OF PIPING AND WATER STORAGE FACILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes requirements for materials and procedures for disinfecting water mains by the continuous feed method and the slug method as well as for disinfecting water storage facilities. The Contractor shall disinfect piping in accordance with Rule 62-555.340, FAC, and AWWA C651, and disinfect water storage facilities in accordance with Rule 62-555.340, FAC, and AWWA C652, except as modified below.

B. Use potable water for chlorination.

C. Submit request for use of water from waterlines of the Owner at least 48 hours in advance.

D. If water for disinfection and/or flushing is supplied from a temporary connection to the existing distribution system, appropriate backflow prevention methods shall be used.

E. Proper disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Disinfected water shall be neutralized in accordance with AWWA C651 and AWWA C652 before discharge.

F. Before permit review and coordination with the Owner and appropriate regulatory authorities (i.e., FDEP and Columbia County Department of Health), the Contractor shall provide a schedule for the rate of flow and locations of discharges for the disinfection of piping and water storage facilities. The neutralized discharge water shall be disposed of by discharging to the nearest sanitary sewer (check with Owner) to the local stormwater system through onsite swales or by other approved means. Discharge to the local stormwater system shall be routed to avoid swale overflow and/or erosion. The Contractor shall be responsible for any damage that occurs related to the discharging process. The Contractor shall repair or replace any damage caused by discharging to the Owner’s satisfaction at no additional expense to the Owner.

G. It is the responsibility of the Contractor to implement and enforce strict adherence to safety guidelines which are addressed in AWWA C651 and AWWA C652 as well as safety and handling instructions from the manufacturer. The Contractor

shall comply with all applicable national, state, and local safety regulations and requirements, including OSHA.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. AWWA B300—Hypochlorites.
2. AWWA B301—Liquid Chlorine.
3. AWWA C651—Disinfecting Water Mains.
4. AWWA C652—Disinfection of Water-Storage Facilities.

B. Florida Administrative Code (FAC)

1. FAC 62-555.340—Disinfection and Bacteriological Evaluation of Public Water System Components.

1.03 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.05 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LIQUID CHLORINE

A. Liquid chlorine shall conform to AWWA B301 and shall be applied in strict accordance with AWWA C651 and AWWA C652.

2.02 CALCIUM HYPOCHLORITE (DRY)

A. Calcium hypochlorite shall conform to AWWA B300 and shall be applied in strict accordance with AWWA C651 and AWWA C652. Calcium hypochlorite intended for swimming pool chlorination shall not be used under any circumstances.

2.03 SODIUM HYPOCHLORITE (SOLUTION)

A. Sodium hypochlorite shall conform to AWWA B300 and shall be applied in strict accordance with AWWA C651 and AWWA C652.

2.04 CHLORINE RESIDUAL TEST KIT

A. For measuring chlorine concentration, the Contractor shall supply and use a medium-range, drop count, DPD drop dilution method kit in accordance with AWWA C651 and AWWA C652. Maintain kits in good working order available for immediate test of residuals at point of sampling.

PART 3 EXECUTION

3.01 GENERAL DISINFECTION PROCEDURE

A. Before disinfection, the Contractor shall inspect materials for quality. The Contractor shall use materials and equipment that are appropriate for the disinfection methods selected. The Contractor shall observe the precautionary guidelines given in AWWA C651 and AWWA C652.

B. During construction, the Contractor shall take preventative measures in accordance with AWWA C651 to protect materials from contamination.

C. Hydrostatic testing shall be successfully performed before disinfection.

D. Before disinfection, the Contractor shall clear water mains and water storage facilities of foreign debris:

1. Pipelines which are less than 24 inches in diameter shall be flushed, while pipelines which are greater than 24 inches in diameter may be cleared via broom-sweeping in accordance with AWWA C651 and as specified in Section 15144, Pressure Testing of Piping. Sweepings shall be removed from pipeline before the disinfection process begins.
2. Water storage facilities shall be cleared of all materials that are not part of the structural or operating facilities of the tank and shall be cleared of all debris in accordance with AWWA C652. After the water storage facility

has been cleaned, all screened openings shall be inspected for quality of materials and adequate condition to prevent the entry of insects, birds, and other possible contaminants into the tank. The Contractor shall properly disinfect any materials that enter the tank after cleaning in accordance with AWWA C652 before placement in the tank.

E. In accordance with AWWA C651 and AWWA C652 procedures, the Contractor shall disinfect all newly constructed materials and existing materials which may have been contaminated during construction. The Contractor shall provide adequate documentation that the required disinfection level (i.e., required chlorine residual and contact time) was successfully achieved.

F. In accordance with Rule 62-555.340, FAC, following disinfection the total chlorine residual in the water mains and water storage facilities shall be reduced to 4 milligrams per liter (mg/L). The chlorine residual may be reduced via flushing with potable water or by a neutralizing agent that conforms to AWWA C651 and AWWA C652.

G. After the total chlorine residual has been reduced to 4 mg/L, the Contractor shall conduct bacteriological testing for water mains and water storage facilities. Bacteriological sampling and testing shall be performed in accordance with Rule 62-555.340, FAC.

H. The Contractor shall dispose of residue from cleaning and other construction operations as well as water from dewatering operations in a manner satisfactory to FDEP and the Columbia County Department of Health.

3.02 CONTINUOUS-FEED METHOD FOR PIPELINES

A. Continuous-feed disinfection shall be performed in accordance with AWWA C651. The Contractor shall introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the free chlorine concentration in the pipeline is maintained at a minimum concentration of 25 mg/L. Inject chlorine into the main at a point no greater than 3 feet downstream of the start of the new water main. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. The water main shall be completely filled with chlorinated water. The chlorine contact time shall be at least 24 hours. The water shall be chlorinated so that after 24 hours the concentration of free chlorine residual in the water main shall be not less than 10 mg/L.

3.03 SLUG METHOD FOR PIPELINES

A. The Contractor shall perform slug method disinfection in accordance with AWWA C651. Introduce the water in the pipeline at a constant measured rate. At a point no greater than 3 feet downstream of the start of the new water main, feed the chlorine solution into the pipeline at a measured rate so that the free chlorine concentration created in the pipeline is 100 mg/L. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes through the line, expose all interior surfaces to a concentration of at least 100 mg/L for at least 3 hours.

3.04 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

A. During the period that the chlorine solution is in the pipeline or as the slug comes into contact with hydrants and valves, open and close valves at least three times to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

3.05 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

A. The Contractor shall disinfect isolation valves, pipe, and appurtenances in accordance with AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

3.06 CONFIRMATION OF RESIDUAL

A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, the Contractor shall confirm that a free chlorine residual of 10 mg/L minimum exists along the pipeline by sampling at air valves and other points of access, such as tapping valves.

B. With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline that the free chlorine concentration in the slug is at least 50 mg/L. If the free chlorine residual is less than 50 mg/L, the flow shall be stopped and the slug residual concentration shall be increased to 100 mg/L before disinfection may resume.

3.07 PIPELINE FLUSHING

A. After confirming the free chlorine residual and sufficient contact time, the Contractor shall flush the excess chlorine solution from the pipeline until the free chlorine concentration in the water leaving the pipe is no higher than 4 mg/L.

3.08 BACTERIOLOGICAL SAMPLING AND TESTING

A. In accordance with Rule 62-555.340, FAC, the Contractor shall collect and deliver required samples to a certified laboratory and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline and in each structure after chlorination and refilling. Samples shall be delivered to a certified laboratory within 6 hours of sampling:

1. For water mains, collect at least one set of samples from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.
2. The Contractor shall take care in the sampling of water storage facilities to ensure that the water sampled is representative of the facility. To obtain a representative sample, the storage facility shall be sampled from a tap connected directly to the storage facility or at a sample tap located on the outlet piping.

B. The Contractor shall take chlorine residual samples at the time bacteriological samples are taken. If the chlorine residual is greater than 4 mg/L, the bacteriological test shall be considered invalid and the residual shall be reduced to 4 mg/L and the bacteriological testing shall be performed until the required criteria are satisfied.

C. In accordance with AWWA C652, the Contractor shall test the water in the storage facility to ensure that no offensive odor has been imparted from the disinfection process.

3.09 REPETITION OF PROCEDURE

A. If the initial chlorination fails to produce required residuals and bacteriologic tests, the Contractor shall repeat the chlorination and testing until satisfactory results are obtained.

B. If the water main is installed before satisfactory bacteriological results are achieved, a precautionary boil water notice must be issued if recommended by the water supplier or if recommended by the Department of Health's *Guidelines for*

the Issuance of Precautionary Boil Water Notices in accordance with Rule 62-555.340, FAC.

3.10 TEST FACILITY REMOVAL

A. After satisfactory disinfection, the Contractor shall disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

3.11 PIPING TO BE DISINFECTED

A. Disinfect all potable water piping and all other piping as indicated in Section 15050, Basic Mechanical Materials and Methods.

B. Disinfect all piping as indicated on the Piping Schedule on the Drawings.

C. Disinfect (internally and externally) any piping inside the following structures:

1. Chlorine Contact Tank.

END OF SECTION

SECTION 15144
PRESSURE TESTING OF PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the hydrostatic, pneumatic, and leakage testing of pressure piping for pumping stations, wastewater treatment plants, water treatment plants, and other facilities; water distribution and transmission mains; and raw sewage force mains and lift stations.

B. Field test pressures shall be in accordance with this Section and as shown in the Pipe Schedule Table in the Contract Documents.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

B. Electronic copies of the test records to the Engineer upon completion of the testing.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. AWWA C600—Installation of Ductile Iron Mains and Their Appurtenances.
2. AWWA C605—Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 TEST PRESSURES

A. Test pressures for the various services and types of piping are shown in the Piping Schedule in the Drawings. At a minimum the Contractor shall perform pressure and leakage test at 1.5 times the maximum system pressure or 100 psi, whichever is greater (based on the elevation or the lowest point of the section under test and corrected for gage location).

1.07 TESTING RECORDS

A. The Contractor shall provide records of each piping installation during the testing. These records shall include the following information:

1. Date and times of test.
2. Identification of process, pipeline, or pipeline section tested or retested.
3. Identification of pipeline material.
4. Identification of pipe specification.
5. Test fluid.
6. Test duration.

B. Test pressure at low point in process, pipeline, or pipeline section.

C. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

D. Certification by Contractor that the leakage rate measured conformed to the Specifications.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 VENTS AND DRAINS FOR ABOVEGROUND PIPING

A. The Contractor shall install vents on the high points of aboveground piping, whether shown in the Drawings or not. Install drains on low points of aboveground piping, whether shown in the Drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4 inch for piping 3 inches and larger and 1/2 inch for piping smaller than 3 inches. Valves shall be ball or gate valves unless otherwise shown on the Drawings. Valves shall be rated for the pressure of the adjacent piping and shall be suitable for use with the adjacent pipe material.

2.02 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

A. The Contractor shall provide temporary manual air-release valves at test bulkheads for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and, after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

2.03 TEST BULKHEADS

A. The Contractor shall design and fabricate test bulkheads in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of the code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

2.04 TESTING FLUID

A. The Owner will provide a source of supply from the existing treated water distribution system for the Contractor’s use in filling the lines. An air break shall be maintained at all times between the Owner’s distribution system and the Contractor’s equipment to prevent cross-connection. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the Contractor. Provide accurate means for measuring the quantity of water required to maintain this pressure. The amount of water required is a measure of the leakage.

B. Testing fluid shall be potable water unless a pneumatic test is indicated on the Piping Schedule.

C. For fuel oil piping, use potable water for hydrostatic testing and flushing.

D. For potable water pipelines, obtain and use only potable water for hydrostatic testing.

E. Submit request for use of water from waterlines of Owner 48 hours in advance.

F. The Contractor shall provide back flow prevention control for temporary connections to existing water mains.

2.05 TESTING EQUIPMENT

A. The Contractor shall provide calibrated pressure gauges, pipes, bulkheads, pumps, compressors, chart recorder, and meters to perform the hydrostatic testing. The Contractor shall provide any necessary assistance required for testing.

PART 3 EXECUTION

3.01 TESTING PREPARATION

A. Pipes shall be in place, backfilled, and anchored before beginning pressure testing.

B. The Contractor shall conduct pressure 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. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. However, perform the final pressure test after completely backfilling and compacting the trench.

D. Install field test pressure gauges and record pressure test gauge elevation above the centerline of the pipeline tested.

E. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the Specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

F. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.

G. Before starting the test, the Contractor shall notify the Engineer and the Owner's Representative.

3.02 CLEANING

A. Before conducting hydrostatic tests, the Contractor shall flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes. Maintain a flushing velocity of at least 3 fps for water testing and at least 2,000 fpm for pneumatic testing. Flush pipes for the period given by the formula:

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)
L = pipe length (feet).

B. For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

3.03 TESTING AND DISINFECTION SEQUENCE FOR POTABLE WATER PIPING

A. Perform required disinfection after hydrostatic testing, unless otherwise indicated.

B. Disinfection shall be performed as described in Section 15141, Disinfection of Piping and Water Storage Facilities.

3.04 LENGTH OF TEST SECTION FOR BURIED PIPING

A. The maximum length of test section for buried pipe of 12 inches or smaller in diameter is 3,500 feet; for buried pipe larger than 12 inches, 1 mile. Provide intermediate test bulkheads where the pipeline length exceeds these limits.

3.05 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

A. The maximum rate of filling shall not cause the water velocity in the pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

3.06 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

A. Before testing new pipelines that are to be connected to existing pipelines, the Contractor shall isolate the new line from the existing line by test bulkheads, spectacle flanges, or blind flanges. After the new line has been successfully tested, remove test bulkheads or flanges and connect to the existing piping.

3.07 HYDROSTATIC TESTING OF ABOVEGROUND OR EXPOSED PIPING

A. Open vents at high points of the piping system to purge air while the pipe is being filled with water. Venting during system filling may also be provided by temporarily loosening flanges.

B. Subject the piping system to the test pressure indicated on the Piping Schedule in the Drawings. Maintain the test pressure for a minimum of 2 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

3.08 HYDROSTATIC TESTING OF BURIED PIPING

A. Where any section of the piping contains concrete thrust blocks or encasement, the Contractor shall not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 24 hours to absorb water before conducting the pressure test.

B. Apply and maintain the test pressure by a positive displacement hydraulic force pump.

C. Maintain the test pressure for the 2 hours by restoring the pressure whenever it falls 5 psi.

D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage volume is defined by the formulas:

PVC Pipe:

$$L = \frac{ND(P)^{1/2}}{C}$$

in which:

L = allowable leakage (gallons)
N = number of rubber-gasketed joints in the pipe tested
D = diameter of the pipe (inches)
P = specified test pressure (psig)
C = 7,400

Ductile Iron Pipe:

$$L = \frac{SD(P)^{1/2}}{C}$$

in which:

L = allowable leakage (gallons)
S = length of pipe tested (feet)
D = diameter of the pipe (inches)
P = specified test pressure (psig)
C = 133,200

HDPE Pipe: As specified in Section 15146, High-Density Polyethylene (HDPE) Pipe.

E. The leakage test shall be a separate test following the pressure test and shall not be less than 2 hours long. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines that fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves, and accessories shall be removed and replaced.

F. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.

G. Submit plan for testing to the Engineer for review at least 10 days before starting the test.

H. Peening shall not be used to repair pinhole leaks in welded pipes. Any leakage in welded pipes shall be repaired by appropriate welding techniques.

I. Repair and retest any pipes showing leakage rates greater than that allowed in the criteria above. Defective materials, pipes, valves, and accessories with excessive leakage shall be removed and replaced.

3.09 HYDROSTATIC FLUSHING AND TESTING OF FUEL OIL PIPING

A. Flush pipes with water to remove dirt and debris. Remove loose foreign material such as scale, sand, weld spatter particles, and cutting chips from the inside of piping assemblies. Hammer on the outside of steel piping with a nonmarring hammer to aid in freeing weld spatter, scale, and dirt.

B. Perform hydrostatic pressure testing as described previously.

C. After successfully completing the pressure testing, blow out the piping with clean, dry air having a dewpoint of at least -40°F. Circulate the air through the piping system until the exiting air has the same dewpoint as the applied air.

3.10 PRESSURE TESTING OF DOUBLE-WALLED CONTAINMENT PIPING

A. Test the primary pipe as described for buried and above-ground or exposed piping.

B. Test the secondary containment piping by performing a pneumatic test as described above of the annular space between the primary and secondary pipes at a pressure of 5 psi.

3.11 REPETITION OF TEST

A. If the actual leakage exceeds the allowable leakage, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

3.12 BULKHEAD AND TEST FACILITY REMOVAL

A. After a satisfactory test, the Contractor shall remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings/linings.

END OF SECTION

SECTION 15145
DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated water mixing valves.
5. Outlet boxes.
6. Hose bibbs.
7. Water-hammer arresters.
8. Trap-seal primer valves.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Mechanical Engineers (ASME)

1. ASME A112.1.2—Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors).
2. ASTM A112.18.1—Plumbing Supply Fittings.
3. ASME B1.20.7—Hose Coupling Screw Threads (Inch).

B. American Society of Sanitary Engineering (ASSE)

1. ASSE 1001—Performance Requirements for Atmospheric Type Vacuum Breakers.
2. ASSE 1003—Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.
3. ASSE 1010—Performance Requirements for Water Hammer Arresters.
4. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.
5. ASSE 1013—Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.
6. ASSE 1017—Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
7. ASSE 1018—Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied.
8. ASSE 1035—Performance Requirements for Laboratory Faucet Backflow Preventers.
9. ASSE 1052—Performance Requirements for Hose Connection Backflow Preventers.

C. American Water Works Association (AWWA)

1. AWWA C550—Protective Interior Coatings for Valves and Hydrants.

D. National Fire Protection Association (NFPA)

1. NFPA 70—National Electrical Code.

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

F. Plumbing and Drainage Institute (PDI)

1. PDI WH 201—Water Hammer Arresters Standard.

1.04 QUALITY ASSURANCE

A. Comply as follows:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

2. NSF Compliance:

a. Comply with NSF 61, "Drinking Water System Components – Health Effects," Sections 1 through 9.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 TESTING REQUIREMENTS

Testing requirements shall be as follows:

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.

4. Body: Bronze.

5. Inlet and Outlet Connections: Threaded.

6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include but are not limited to the following:

    a. Arrowhead Brass Products, Inc.
    b. Conbraco Industries, Inc.
    c. MIFAB, Inc.
    d. Watts Industries, Inc.; Water Products Div.
    e. Woodford Manufacturing Company.
    f. Zurn Plumbing Products Group; Light Commercial Operation.
    g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.

3. Body: Bronze, nonremovable, with manual drain.

4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

5. Finish: Chrome or nickel plated.

C. Laboratory-Faucet Vacuum Breakers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.
c. Woodford Manufacturing Company.
d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1035.

3. Size: NPS 1/4 or NPS 3/8 matching faucet size.

4. Body: Bronze.

5. End Connections: Threaded.

6. Finish: Chrome plated.

7. Accessories:

a. Valves: Ball type on inlet and outlet.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

a. Zurn Plumbing Products Group; Wilkins Div. (Model# 375 or engnineer-approved equal)
b. FEBCO; SPX Valves & Controls.
c. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1013.

3. Operation: Continuous-pressure applications.

4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

5. Size: As indicated on Drawings.

6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

8. Configuration: Designed for horizontal, straight-through flow.

9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

10. The interior of the backflow preventer shall be epoxy coated in accordance with AWWA C550 and be NSF approved. Backflow preventer shall be equipped with a thermally activated valve set for freeze protection installed on the downstream side of the backflow preventer. Thermally activated valve shall be Crispin Model TAVS or approved equal.

11. Manufacturer-recommended flow range of each unit shall be provided in the shop drawing submittal. The reduced-pressure backflow preventer shall be installed where its discharge will not be objectionable or will not cause a safety hazard and where it can be positively drained away from the unit when installed within a structure. When the preventer is installed in a structure, the Contractor shall provide a 12-inch air gap accessory and a drain pipe in the floor slab, connected to the RPBP air gap accessory, to drain the RPBP discharge to the closest floor drain.

B. Hose-Connection Backflow Preventers:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

   a. Conbraco Industries, Inc.
   b. Watts Industries, Inc.; Water Products Div.
   c. Woodford Manufacturing Company.

2. Standard: ASSE 1052.

3. Operation: Up to 10-foot head of water (30-kPa) back pressure.

4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).

5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.

6. Capacity: At least 3-gpm (0.19-L/s) flow.

2.03 WATER-PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

   a. Conbraco Industries, Inc.
   b. Honeywell Water Controls.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.

3. Pressure Rating: Initial working pressure of 150 psig.

4. Size: As indicated on the Drawings.

5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.

6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.04 TEMPERATURE-ACTUATED WATER-MIXING VALVES

A. Water-Temperature-Limiting Devices:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

   a. Armstrong International, Inc.
   b. Cash Acme.
   c. Conbraco Industries, Inc.
   d. Honeywell Water Controls.
   e. Legend Valve.
   f. Leonard Valve Company.
   g. Powers; a Watts Industries Co.
   h. Symmons Industries, Inc.
   i. Taco, Inc.
   j. Watts Industries, Inc.; Water Products Div.
   k. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.

3. Pressure Rating: 125 psig.

4. Type: Thermostatically controlled water-mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.

6. Connections: Threaded union inlets and outlet.

7. Accessories: Check stops on hot- and cold-water supplies and adjustable temperature-control handle.

8. Valve Finish: Rough bronze.

2.05 HOSE BIBBS

A. Hose Bibbs (HB-1):

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.

3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Include integral wall flange with each chrome- or nickel-plated hose bibb.
9. Provide freeze protection.

2.06 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. PPP Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Tyler Pipe; Wade Div.
    h. Watts Drainage Products Inc.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI WH 201.

3. Type: Metal bellows.

4. Size: ASSE 1010, Sizes AA and A through F or PDI WH 201, Sizes A through F.

2.07 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the following:

    a. MIFAB, Inc.
    b. PPP Inc.

c. Sioux Chief Manufacturing Company, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig (860 kPa) minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.

6. Finish: Chrome plated or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 EXECUTION

3.01 INSTALLATION

To ensure proper installation the Contractor shall do the following:

A. Install water regulators with inlet and outlet shutoff valves. Install pressure gauges on inlet and outlet.

B. Install water hammer arresters in water piping according to PDI WH 201.

C. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1% and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 15, Mechanical, sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according with Division 16, Electrical, sections.

C. Connect wiring according to Division 16, Electrical, sections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Water-pressure-reducing valves.
3. Supply-type trap-seal primer valves.

B. Distinguish among multiple units, inform the operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations in addition to identifying the unit. Nameplates and signs are specified in Division 15, Mechanical.

3.04 FIELD QUALITY CONTROL

A. The Contractor shall perform the following tests and prepare test reports:

1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.
2. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.05 ADJUSTING

A. Set field-adjustable pressure set points of water-pressure-reducing valves.

END OF SECTION

SECTION 15146
HIGH-DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Description: The Contractor shall provide all materials and incidentals, including piping, molded and ductile iron fittings, flanged adapters, flanged joints, mechanical joint adapters, hardware, and appurtenances for the HDPE piping systems shown on the Drawings and the Drawing Process Flow Identification.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance, and Section 15055, Piping Systems—General.

A. In general, shop drawings and related manufacturer's product certification shall be made in accordance with the General and Special Conditions of the Contract for approval before the manufacturer constructs or fabricates the material. The following items, which require shop drawings, are brought to the Contractor's attention. The list may not include all items for which shop drawing submittals are required to meet the requirements of the project.

1. Detail drawings of all classes of pipe, joints, and fittings.
2. Detail Drawings of all joints, including manufacturer's certified factory and/or laboratory test reports to confirm thrust-restraint capacities and restraining mechanism application.
3. Existing piping connection details.
4. Adapters for connection to mechanical joint valves and ductile iron pipe fittings.

B. Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be furnished by the HDPE pipe manufacturer for the manufacturer's own products in accordance with the latest standards of the industry as described in this Section.

C. Provide a statement in writing from the HDPE pipe manufacturer that the manufacturer is listed with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin to be used in the manufacture of the pipe for this project.

D. All persons making heat fusion joints shall receive training in the manufacturer's recommended procedures. The Contractor shall maintain records of trained

personnel and certify that training was received not more than 12 months before construction began. Additionally, the Contractor shall have worked on one or more projects involving combined installation of at least 10,000 feet of HDPE butt-fusion-welded pipe and shall provide the Engineer with a written list of HDPE pipeline installation experience, including project location, date, Owner, and personnel assigned and installing on this project.

E. The pipe manufacturer shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be onsite to oversee all pipe joining. All costs for the manufacturer's representative shall be paid for by the Contractor.

F. The Contractor shall provide qualifications of the proposed firm to be used to clean, inspect, and videotape HDPE piping for record purposes. The Contractor shall submit a video record on DVD when the system is complete. The DVD shall be clearly labeled with the video inspection date, pipe starting and ending point, name, address, and phone number of firm performing the videotaping. Each section of pipe that is video inspected shall have a complete dialogue dubbed onto the video recording that at a minimum describes the length of pipe videotaped, the location of pipe videotaped, all welds, any deflections, and other features of interest.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
2. ASTM D3261—Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
3. ASTM D3350—Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
4. ASTM D4976—Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
5. ASTM F714—Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.

B. American Water Works Association (AWWA)

1. AWWA C151/A21.51—Ductile Iron Pipe, Centrifugally Cast, for Water.
2. AWWA C901—Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch (13 mm) through 3-Inch (76 mm), for Water Service.
3. AWWA C906—Polyethylene (PE) Pressure Pipe and Fittings, 4-Inch through 65-Inch (100 mm Through 1,650 mm), for Waterworks.

C. International Organization for Standardization (ISO)

1. ISO 9001—Quality Management Systems – Requirements.

1.04 QUALITY ASSURANCE

A. The pipe and fitting manufacturer(s) shall have an established quality-control program responsible for inspecting incoming and outgoing materials. Incoming polyethylene materials shall be inspected for density, melt flow rated, and contamination. The cell classification properties of the material shall be certified by the supplier and verified by the manufacturer's quality control.

1.05 TESTING REQUIREMENTS

A. See Section 15144, Pressure Testing of Piping.

1.06 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.07 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15055, Piping Systems—General, for storing and protecting the items specified in this Section.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. General

1. All HDPE shall be DriscoPlex PE 4000 or 4100 HDPE; or approved equal.
2. All HDPE pipe 8 inches in diameter or greater shall have a Ductile Iron Pipe Size (DIPS) outside diameter, and HDPE pipe smaller than 8 inches in diameter shall be IPS unless otherwise specified or shown in the Drawings.
3. All HDPE piping system components shall be the products of one manufacturer.
4. Pipe and fittings shall be manufactured by an ISO 9001-certified manufacturer.

B. HDPE Pipe

1. HDPE pipe 8 inches in diameter and larger shall conform to material standard ASTM D3350 cell classification of PE445574C rated as PE 4710 by the Plastics Pipe Institute. Minimum pressure rating shall be in accordance with Piping Schedule Drawing or as specified in this Section. Minimum pressure rating shall be 125 psi SDR 17 (Standard Dimension Ratio) for pipe sizes greater than 8 inches in diameter. For pipe sizes 8 inches and smaller in diameter, the minimum pressure rating shall be 200 psi SDR 11.
2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light.
3. The maximum allowable hoop stress shall be 800 psi at 73.4ºF.
4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the requirements of the resin manufacturer to manufacture pipe from the resin used.
5. The HDPE pipe shall include color stripes to identify the application in accordance with the pipe schedule provided in the Contract Drawings.

C. Fittings

1. The pipe manufacturer shall mold or fabricate the polyethylene fittings. Butt fusion outlets shall be made to the same outside diameter, wall thickness, and tolerances as the mating pipe. All fittings and custom

fabrications shall be fully rated for the same internal pressure as the mating pipe.

a. Molded Fittings: Molded fittings shall be manufactured in accordance with ASTM D3261 and shall be so marked. Each production lot of molded fittings shall be subjected to the test required under ASTM D3261. The manufacturer shall submit samples from each molded fitting production lot to x-ray inspection for voids and shall certify that voids were not found.

(1) Polyethylene Flange Adapters: Flange adapter shall be made with sufficient throughbore length to be clamped in a butt fusion joining machine without the use of a subend holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves to restrain the gasket against blow-out. Flange adapters shall be fitted with ductile-iron backup rings pressure rated equal to or greater than the mating pipe. The Contractor shall provide flat ring-type EPDM gaskets with gasket thickness and hardness as recommended by the pipe manufacturer for use with HDPE flanged joints. Provide carbon steel hardware (bolts, nuts, washers, etc.) conforming to ASTM A307, Grade B for use with the flange adapters assemblies in accordance with the pipe manufacturer's recommendations. Gaskets shall be made from material suitable for exposure to the liquid within the pipe.

b. Fabricated Fittings: Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service equivalent to the full-service pressure rating of the mating pipe. Pressure de-rated fittings are not acceptable. Directional fittings 16 inches IPS and larger, such as elbows, tees, crosses, etc., shall have a plain end inlet for butt fusion and flanged directional outlets.

2. D.I./HDPE Mechanical Joint Adapters.

a. The manufacturer of the HDPE pipe shall supply all D.I./HDPE mechanical joint adapters and accessories required to connect plain-end HDPE piping to mechanical joint fittings, valves, and appurtenances.

b. The D.I./HDPE mechanical joint adapter shall consist of:

(1) A molded or fabricated HDPE mechanical joint transition fitting.
(2) A Buna-N gasket for a D.I. mechanical joint.
(3) A ductile iron mechanical joint backup drive ring.
(4) Cor-Ten mechanical joint tee bolts.
(5) A stainless-steel sleeve stiffener molded or fabricated within the MJ end of the HDPE mechanical joint adapter fitting.

c. The D.I./HDPE mechanical joint adapter shall be connected to the HDPE pipe by a heat-fused joint on one end and connected to a ductile iron pipe valve, fitting, or appurtenance with the internally stiffened mechanical joint end.

d. The tee bolts and backup drive ring shall act as a joint restraint for connections to mechanical joints.

e. The HDPE mechanical joint adapter fitting shall be molded or fabricated by the manufacturer of the HDPE pipe. All molded fittings shall be fully pressure rated to match the SDR pipe pressure rating. Fabricated fittings shall be rated for internal pressure service equivalent to the full pressure rating of the mated IPS pipe.

f. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

g. Solvent epoxy cementing and mechanical joining with bolt on wrap-around clamps shall not be used.

3. Ductile-iron fittings connected to SDR 17 HDPE pipe (8 inches and larger) shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.

D. HDPE Pipe Jointing Method

1. HDPE pipe shall be jointed by butt fusion in accordance with the pipe manufacturer's directions and only for pipe within one SDR ratio of each other.
2. For SDR ratios that are two or more apart (i.e., SDR 17 to SDR 11), the joint shall be made using a restrained joints. Same-diameter pipe may be

joined by using HDPE flange adapters and backup rings bolted to each other.

3. All HDPE pipe joined by butt fusion shall be made from the same class and type of raw material made by the same raw material supplier.
4. *Butt fusion* means the butt joining of the pipe by heat fusion aligned faces of the pipe ends (butts) in a suitable apparatus and joining under controlled pressure and alignment.
5. The external bead resulting from the butt-fusion process shall be visible and examined for complete butt-fusion 360º around the pipe exterior.
6. Short spools of pipe between valves and fittings shall be ductile iron pipe, with all joints restrained for sizes 8 inches and larger. For 2-inch, the spool shall be Schedule 40 Type 304 stainless steel piping or Schedule 80 PVC piping with IP threads stainless steel or PVC fittings and all joints restrained.
7. Where approved by the Engineer, the HDPE pipe and fittings may be fused with Electrofusion Couplings, as manufactured by Central Plastics Company, or approved equal. Technical information must be provided to demonstrate that the fused coupling will not compromise the structural integrity of the HDPE pipe.

2.02 LOCATOR WIRE

A. All HDPE piping shall be installed with two insulated 12-gauge minimum AWG solid strand copper wires detectable pipeline marking tape for location purposes as specified in Section 15055, Piping Systems—General.

PART 3 EXECUTION

3.01 GENERAL

A. All polyethylene pipe shall be cut, fabricated, joined, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with HDPE pipe.

3.02 LAYING PIPE

A. Joints

1. All HDPE to HDPE pipe joints shall be joined by heat fusion that produces homogeneous, sealed, leak-tight joints.
2. Restrained mechanical joint adapters shall be provided at tie-ins with valves, ductile iron fittings, and other pipe materials.

B. Butt Fusion Testing

1. The Contractor shall test the first fusion of each day.
2. In testing, the fusion shall be allowed to cool completely and then fusion test straps shall be cut out. The test shall be a minimum of 12 inches or 30 times the wall thickness in length with the fusion in the center and a minimum of 1 inch or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. The Contractor shall not begin until a fusion test has passed the bent strap test.

C. Pipe Deflection

1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed 75% of that recommended by the manufacturer.

D. Pipe Cutting

1. Cutting HDPE butt fusion connections to HDPE pipe, valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without damaging the pipe. Ends shall be cut square and perpendicular to the pipe axis.

3.03 FLUSHING AND CLEANING

A. Flushing and Cleaning shall be as specified in Section 15144, Pressure Testing of Piping.

3.04 TESTING AND LEAKAGE

A. Hydrostatic Tests—General

1. All testing shall comply with Section 15144, Pressure Testing of Piping, except as specified in this Section.

2. All field tests shall be made in the presence of the Owner or Engineer. Except as otherwise directed, all pipelines shall be tested. All piping to operate under liquid pressure shall be tested in sections of approved length, typically from valve to valve and in no case longer than 1,000 feet.

3. Hydrostatic testing shall consist of a combined pressure test and leakage test. The field test pressure shall be as indicated on the Pipe Schedule Table on the Drawings, measured at the lowest point of the section being

tested. The pressure shall be applied by a pump connected to the pipe in a manner satisfactory to the Engineer. The pump, pipe connection, and all necessary apparatus shall be furnished by the Contractor and shall be subject to the satisfaction of the Engineer.

4. The maximum duration for any test, including initial pressurization, initial expansion, and time at test pressure, must not exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section and allow it to "relax" for at least 8 hours before bringing the test section up to test pressure again.

5. Monitored Make-Up Water Test: The test procedure consists of initial expansion and test phases.

    a. During the initial expansion phase, the test section is filled with water. Once the line is filled, make-up water is added at hourly intervals as required to maintain the test pressure for 3 hours.
    b. At the end of the initial expansion period, the addition of make-up water will cease. During the test phase the pipe will not have any water added to it for the following 2 hours. The 2 hours will be the actual leakage test. At the end of the 2-hour period, measured make-up water will be added to the pipe to return it to the original test pressure.
    c. If the amount of make-up water added is greater than calculated using the numbers listed below, the section being tested will be considered to have a leak. The leak shall be found and fixed at the Contractor's expense and that section of the line retested before continuing with subsequent leakage tests. Testing and repairs shall be repeated at the Contractor's expense until the amount of make-up water is less than the amount calculated using the numbers listed below.

ALLOWABLE FOR EXPANSION UNDER TEST PRESSURE*
POLYETHYLENE PIPE

Nominal Pipe Size (in.)	Allowances for Expansion (US Gal/100 Feet of Pipe)		
	1-Hour Test	2-Hour Test	3-Hour Test
2	0.08	0.12	0.15
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
24	4.5	8.9	13.3
30	6.2	12.6	19.1
36	9.0	18.0	27.0
42	12.0	24.0	36.0
48	15.0	27.0	43.0

*These allowances only apply to the test phase and not to the initial expansion phase.

B. Video Inspection

1. All HDPE gravity piping (solid wall and perforated) shall be jet cleaned and then video inspected before final inspection. The Contractor shall provide all equipment and labor for such cleaning and inspection. Any Subcontractor must be approved by the Owner before work can begin.
2. Video inspection shall be performed after cleaning and pressure testing (when pressure testing is required) the pipe. If cleaning and video inspection of each pipe run from its respective cleanout is not possible, the Contractor shall correct installation deficiencies to allow cleaning and video inspection of the entire length.
3. Digital video recordings shall be taken of all inspections. The Contractor shall prepare a DVD video record of the inspection for submission as detailed in Paragraph 1.02F. The DVD shall be accompanied by an inspection log in addition to a summary report.

END OF SECTION

SECTION 15150
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For pipe, tube, fittings, and couplings.
B. Field quality-control inspection and test reports.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D2665—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
3. ASTM D3311—Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

B. American Water Works Association (AWWA)

1. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.
2. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C153/A21.53—Ductile-Iron Compact Fittings.

C. National Sanitation Foundation (NSF)

1. NSF 14—Plastics Piping System Components and Related Materials.

1.04 QUALITY ASSURANCE

A. Piping materials shall bear a label, stamp, or other markings of the specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 TESTING REQUIREMENTS

A. Components and installation shall be able to withstand the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

1.09 DEFINITIONS

A. *PVC*: Polyvinyl chloride plastic.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include but are not limited to the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent.

1. PVC Socket Fittings: ASTM D2665, socket type, made to ASTM D3311, drain, waste, and vent patterns.

2.04 SPECIAL PIPE FITTINGS

A. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20° deflection, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and steel bolts:

1. Available Manufacturers:

a. SIGMA Corp.

PART 3 EXECUTION

3.01 EXCAVATION

A. Refer to Section 02305, Earthwork for Utilities, for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

A. Aboveground soil and waste piping shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

B. Aboveground vent piping shall be the following:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Underground soil, waste, and vent piping shall be the following:

1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.03 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Section 02530, Pipework, Gravity Sewers.

B. Basic piping installation requirements are specified in Section 15050, Basic Mechanical Materials and Methods.

C. The Contractor shall install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install a wall-penetration fitting at each service pipe penetration through foundation wall. Make the installation watertight.

E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double-Y branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90°. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing the size of drainage piping in the direction of flow is prohibited.

F. Lay buried building drainage piping beginning at the low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to the manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2% downward in the direction of flow for piping NPS 3 and smaller; 1% downward in the direction of flow for piping NPS 4 and larger.
2. Vent Piping: 1% down toward the vertical fixture vent or toward the vent stack.

H. Install PVC soil and waste drainage and vent piping according to ASTM D2665.

I. Install underground PVC soil and waste drainage piping according to ASTM D2321.

J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.04 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Section 15050, Basic Mechanical Materials and Methods.

B. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665.

3.05 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Section 15060, Pipe Hangers and Supports. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.

2. Individual, Straight, Horizontal Piping Runs: According to the following:

a. MSS Type 1, adjustable, steel clevis hangers.

B. Install supports according to Section 15060, Pipe Hangers and Supports.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches with 3/8-inch rod.
2. NPS 3 (DN 80): 48 inches with 1/2-inch rod.
3. NPS 4 and 5 (DN 100 and 125): 48 inches with 5/8-inch rod.
4. NPS 6 (DN 150): 48 inches with 3/4-inch rod.

F. Install supports for vertical PVC piping every 48 inches.

G. Support piping and tubing not listed above according to MSS SP-69 and the manufacturer's written instructions.

3.06 CONNECTIONS

A. The Drawings indicate the general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide a shutoff valve, if indicated, and a union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.07 FIELD QUALITY CONTROL

A. During installation the Contractor shall notify authorities having jurisdiction at least 24 hours before inspection must be made. The Contractor shall perform the tests specified below in the presence of authorities having jurisdiction:

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspection, the Contractor shall make the required corrections and arrange for reinspection.

C. Reports: The Contractor shall prepare inspection reports and have them signed by authorities having jurisdiction.

D. The Contractor shall test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection to the completion of inspection, the water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave the building. Introduce air into the piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in the trap of the water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout the inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping or portions of piping until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.08 CLEANING

To ensure proper cleaning the Contractor shall do the following:

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during the remainder of construction to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at the end of day and when work stops.

3.09 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint. Paint and flashing shall match the color of the adjacent roofing.

END OF SECTION

SECTION 15155
DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all materials and incidentals, including piping, fittings, flanged joints, mechanical joints, retainer glands, polyethylene bagging for buried ductile iron piping, fittings, valves, and appurtenances for the ductile iron piping systems required for the work shown on the Drawings, in the Drawing—Piping Schedule, and described in Section 15060, Pipe Hangers and Supports.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry where the material for this project is manufactured. The Contractor shall submit sworn certificates of such tests and their results.

B. Shop Drawings, including layout drawings, shall be submitted as specified in Section 15055, Piping Systems—General.

C. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable Sections of the Specifications.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

2. ASTM A194/A194M—Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
3. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 psi Tensile Strength.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM A563—Standard Specification for Carbon and Alloy Steel Nuts.
6. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
7. ASTM C150/C150M—Standard Specification for Portland Cement.
8. ASTM C283—Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
9. ASTM D714—Standard Test Method for Evaluating Degree of Blistering of Paints.
10. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
11. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.
12. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.
13. ASTM G95—Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

B. American Society of Mechanical Engineers (ASME)

1. ASME B1.1—Unified Inch Screw Threads (UN and UNR Thread Form).
2. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
3. ASME B16.21—Nonmetallic Flat Gaskets for Pipe Flanges.

C. American Water Works Association (AWWA)

1. AWWA C104/A21.4—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110/A21.10—Ductile-Iron and Gray-Iron Fittings.
3. AWWA C111/A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115/A21.15—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C150/A21.50—Thickness Design of Ductile-Iron Pipe.
6. AWWA C151/A21.51—Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153/A21.53—Ductile-Iron Compact Fittings.
8. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).

9. AWWA C600—Installation of Ductile-Iron Mains and their Appurtenances.
10. AWWA C651—Disinfecting Water Mains.

D. International Organization for Standardization (ISO)

1. ISO 9001—Quality Management Systems – Requirements.

E. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

1. The ductile iron pipe manufacturer shall submit certification that the pipe and fitting products meet all tests required by AWWA C151/A21.51.
2. All materials shall be new and have a manufacturer's certificate verifying compliance to all tests and inspections as required in this Section. The weight, class, and casting period shall be shown on each piece of pipe. The manufacturer's "mark," the year produced, and the word "Ductile" or the letters "DI" shall be cast or stamped on all pipe.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.07 TESTING REQUIREMENTS

A. See Section 15144, Pressure Testing of Piping, for testing requirements.

1.08 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. All ductile iron piping shall be designed and manufactured in accordance with AWWA C150/A21.50 and AWWA C151/A21.51 for the following minimum operating conditions:

1. The minimum internal design pressure shall be 150 psi with a 100-psi surge allowance, with a safety factor of 2, for a total internal design pressure of 500 psi.

2. The external loads design criteria shall be for the minimum cover indicated on the Drawings at 120 pounds per cubic feet soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150/A21.50.

3. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed 3% of the pipe diameter based on the trench design shown on the Drawings.

4. Pressure Class: All ductile iron piping shall meet the following minimum working pressure classes:

   a. 4 inches through 12 inches: 350 psi
   b. Pipe greater than 12 inches: 250 psi

2.02 JOINTS

A. Ductile iron fittings shall be furnished with push-on joint, mechanical joints and flanged joint ends as shown on the Drawings and specified in this Section:

1. Push-On Joints: Push-on joints shall conform to AWWA C111/A21.11. Gaskets shall be Viton.
2. Mechanical Joints: All buried ductile iron fittings shall be furnished with mechanical joint ends unless noted otherwise. Mechanical joints shall conform to AWWA C111/A21.11. Glands shall be constructed of ductile iron.
3. Flanged Joints: Pipe for threaded flange fabrication shall be Special Thickness Class 53 in accordance with AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C115/A21.15. Bolt circle and bolt holes shall match those of ASME B16.1 Class 125 flanges. The flanges shall be rated for a maximum working pressure of 250 psi. Threaded flanges shall be individually fitted and machine tightened on the pipe ends.

Flange facing shall be smooth or with shallow serrations in accordance with AWWA C115/A21.15.

2.03 FITTINGS

A. General: Ductile iron pipe fittings shall be the compact type meeting the requirements of AWWA C110/A21.10 and AWWA C153/A21.53 where applicable. Ductile iron fittings shall be cement lined and seal coated. Lining of fitting shall conform to lining specified for piping and service as specified on the Drawing—Flow Stream Identification. Fittings shall be manufactured in accordance with AWWA C110/A21.10. Where taps are shown on fittings, tapping bosses shall be provided. At a minimum, fittings shall have the same pressure rating as the connecting pipe.

1. Flanged Joint: AWWA C110/21.10 and ASME B16.1, faced and drilled 125-pound ANSI standard.

2. Mechanical Joint: AWWA C110/A21.10

   a. Provide mechanical joint fittings for all buried fittings as shown in the Drawings, unless noted otherwise.
   b. Provide specified gaskets.

2.04 LINING AND COATING

A. The Contractor shall provide lined ductile iron piping and fittings in accordance with the Drawing—Flow Stream Identification. The Contractor shall perform all field measurements confirming the accuracy of the piping sizes and lengths shown on the Drawings. The Contractor shall notify the Engineer immediately before deviating from or altering the lining of ductile iron piping shown on the approved layout schedule.

B. Epoxy-Lined Pipe and Fittings

1. General: The lining applied to the interior of pipe and fittings shall be a polyamine ceramic-type epoxy, 100% solids by volume, containing at least 20% by volume of ceramic quartz pigment or hollow ceramic spheres, applied to a total dry-film thickness (DFT) of 40 mils minimum and to a maximum of 60 mils total DFT. The lining products (materials) shall be provided from a manufacturer of industrial-grade epoxy coating systems with a minimum of 10-years' experience. The lining shall be applied by a competent pipe and fittings lining specialty firm with a minimum of 3 years of documented successful experience applying ceramic epoxy linings to the interior of ductile iron pipe and fittings.

2. Lining Materials: Lining material shall meet the following requirements and properties:

   a. A permeability rating of 0.00 when tested according to Method A of ASTM E96, Procedure A with a test duration of 30 days.

   b. The following test shall be run on coupons from lined ductile pipe:

Test Parameter	ASTM Test Method	Typical Value
Salt Spray	B117	0.0 undercutting after 2 years
Cathodic disbondment 1.5 volts @ 77°F	G95	No more than 0.5 mm undercutting after 30 days
Immersion	D714	No effect after 2 years for 20% sulfuric acid, 140°F 25% sodium hydroxide, 160°F distilled water
Immersion	D714	0.0 undercutting after 2 years for 120°F tap water

3. Application: The lining applicator shall prepare interior pipe and fitting surfaces and apply lining according to the requirements of the lining products manufacturer's specifications, surface preparation, and application methods and procedures. Linings shall be applied to non-lined or non-coated pipe and fitting interiors. Previously coated or lined pipe and fittings shall not be used for lining with the ceramic epoxy products.
4. The Contractor shall notify the Engineer immediately before cutting ceramic epoxy-lined ductile iron pipe in the field. The Contractor shall repair the cut end in accordance with the pipe manufacturer's written procedures.
5. The lining material shall be Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Inc., Tnemec Series 431 Perma-Shield PL, or approved equal.

C. Cement-Lined Ductile Iron Pipe and Fittings: Interior surfaces of all cement-lined ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104/A21.4, Portland cement mortar. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the Contractor shall repair or replace damaged or unsatisfactory portions with

lining conforming to these Specifications at no additional cost to the Owner. Pipe linings for potable water lines shall be NSF 61 approved.

1. All ductile iron pipe and fittings cement-mortar linings shall be surface sealed with an asphaltic seal coating, 1 mil, in accordance with AWWA C104/A21.4.

D. Glass Lined Pipes and Fittings:

1. General: The lining shall be applied by a competent pipe lining specialty firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

2. Lining Materials: The lining material shall be vitreous and inorganic and the lined pipe and fittings shall meet the following requirements and properties:

Test Parameter	Test Method	Typical Value
Minimum density	ASTM D792	2.5 to 3.0 grams per cubic centimeter
Thermal shock of 350°F		Without crazing, blistering, or spalling
Immersion in 8% sulfuric acid at 125°F for 15 minutes	ASTM C283	A weight loss of no more than 3 milligrams per square inch

The glass-lined pipe and fittings shall be resistant to corrosion in a pH range of 3 to 10 at 125°F. It shall have a hardness of 5 to 6 on the Mohs scale.

3. Application: The lining shall be applied by an ISO 9001 certified firm with a successful history of applying glass linings to the interior of ductile iron pipe and fittings.

2.05 MANUFACTURERS

A. Acceptable ductile iron pipe manufacturers include US Pipe, American Ductile Pipe, Griffin Pipe, or approved equal.

2.06 BOLTS

A. General: The Contractor shall provide carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Threads shall be as specified in ASME B1.1 coarse thread series, Class 2A external and Class 2B internal.

Nuts, bolts, and gaskets for flanged fittings and blind flanges shall be designed to withstand the design and test pressure ratings for the pipe.

2.07 GASKETS

A. Gaskets for mechanical joints shall be compatible with sewage pipe service. See Section 15055, Piping Systems—General, for gasket requirements.

B. Gaskets for flanged joints shall be 1/8-inch-thick, cloth-inserted rubber conforming to applicable parts of ASME B16.21 and AWWA C207. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in sewage and reclaimed water lines. Gaskets shall be full-face type for 125-pound flanges.

2.08 RETAINER GLANDS

A. Retainer glands shall be provided for all buried ductile-iron mechanical joints, fitting, and ductile-iron pipe connections to buried valves. Retainer glands shall be designed for joint retaining through the use of a follower gland and set screw-anchoring devices that impart multiple wedging action against the pipe. The mechanical joint-restraint device shall be UL listed and shall have a working pressure of at least 250 psi with a minimum safety factor of 2.

1. Gland: Manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall match AWWA C111/A21.11 and AWWA C153/A21.53.

2. Restraining Devices: Manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Restraining devices shall incorporate a set screw/twist-off nut bolt to ensure the proper actuating of the restraining device. The twist-off nut shall be designed to come off at the torque limit desired to anchor the restraining device in place on the pipe.

3. Joint Deflection: Retainer gland joint deflection shall be limited to manufacturer's recommended maximum deflection angle. Joint deflection shall be applied before the set screws are torqued.

4. Acceptable Manufacturers:

    a. EBAA Iron, Inc. – Megalug 1100 Series.
    b. Or approved equal.

2.09 EXTERNAL PIPE RESTRAINTS

A. Ductile iron pipe push-on (bell and spigot) joint restraint shall be provided by a restraining harness consisting of a restraint ring, connecting tie-rods, and split-ring assembly installed at all push-on joints. The restraint ring shall consist of wedging components made from 60-42-12 ductile iron conforming to ASTM A536 and wedges heat treated to minimum 370 BHN. Torque limiting twist-off nuts shall be provided on each wedge to ensure proper applied installation torque. The split ring shall be made from 60-42-12 ductile iron conforming to ASTM A536. The connecting rods shall be made of steel conforming to AWWA C111/A12.11. Sizes 4- to 16-inch-diameter restraining harnesses shall have 350 psi maximum working pressure rating and 18- to 36-inch-diameter restraining harnesses shall have 250 psi maximum working pressure rating. All harnesses shall be designed with a 2-to-1 safety factor applied to the maximum working pressure rating.

B. Acceptable Manufacturers:

1. EBAA Iron, Inc. – Series 1700.
2. Or approved equal.

2.10 INTERNAL PIPE RESTRAINT

A. Acceptable Manufacturers:

1. American Ductile Iron Pipe:

a. Fast Grip ® Gasket.
b. Flex Ring ® Joint.

2. US Pipe:

a. Field Lok ® Gasket.
b. TR Flex Restrained Joint Pipe and Fittings.

3. Or Engineer-approved equal.

2.11 POLYETHYLENE BAGGING

A. Polyethylene bagging for buried ductile iron pipe, fittings, and valves shall be 8 mils thickness minimum polyethylene, manufactured in accordance with ASTM D1238, Type I, Class C, Grade E1.

2.12 COLOR CODING OR MARKING

A. All potable water main pipe, including fittings, shall be color coded or marked using blue as a predominant color to differentiate drinking water from reclaimed or other water. Underground plastic pipe shall be solid-wall blue pipe, shall have a co-extruded blue external skin, or shall be white or black pipe with blue stripes incorporated into or applied to the pipe wall; and underground metal or concrete pipe shall have blue stripes applied to the pipe wall. Pipe striped during manufacturing of the pipe shall have continuous stripes that run parallel to the axis of the pipe, that are located at no greater than 90° intervals around the pipe, and that will remain intact during and after installation of the pipe. If tape or paint is used to stripe pipe during installation of the pipe, the tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and that is located along the top of the pipe; for pipes with an internal diameter of 24 inches or greater, tape or paint shall be applied in continuous lines along each side of the pipe as well as along the top of the pipe. Marking tape shall be 3 inches wide with adhesive backing. Paint stripe shall be 3 inches wide. Aboveground pipe at drinking water treatment plants shall be color coded and labeled in accordance with subsection 62-555-320(10), FAC, and all other aboveground pipe shall be painted blue or shall be color coded or marked like underground pipe.

B. All reclaimed water valves and outlets shall be appropriately tagged or labeled bearing the words in English and Spanish. All piping, pipelines, valves, and outlets shall be color coded or otherwise marked to differentiate reclaimed water from domestic or other water. Underground ductile iron pipe shall be color coded or marked using purple as a predominant color. If tape is used to mark the pipe, the tape shall be permanently affixed to the top and each side of the pipe (three locations parallel to the axis of the pipe). For pipes less than 24 inches in diameter, a single tape may be used along the top of the pipe. Visible, aboveground portions of the reclaimed water distribution system shall be clearly color coded or marked.

C. All wastewater pipe, including fittings, shall be color coded or marked using green as a predominant color to differentiate. Underground plastic pipe shall be solid-wall green pipe, shall have a co-extruded green external skin, or shall be white or black pipe with green stripes incorporated into or applied to the pipe wall; and underground metal or concrete pipe shall have green stripes applied to the pipe wall. Pipe striped during manufacturing of the pipe shall have continuous stripes that run parallel to the axis of the pipe, that are at no greater than 90° intervals around the pipe, and that will remain intact during and after installation of the pipe. If tape or paint is used to stripe pipe during installation of the pipe, the tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and that is along the top of the pipe; for pipes with an internal diameter of 24 inches or greater, tape or paint shall be applied in continuous lines along each

side of the pipe as well as along the top of the pipe. Marking tape shall be 3 inches wide with adhesive backing. Paint stripe shall be 3 inches wide.

PART 3 EXECUTION

3.01 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, fitting, lining, and coating. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before installation, and no piece that the Engineer finds defective shall be installed. The Contractor shall repair any damage to the pipe and fittings coating and/or lining as directed by the Engineer. If the Engineer determines that the coating and/or lining cannot be repaired, the Contractor shall replace the damaged pipe and fittings at no additional compensation.

B. All pipe and fittings shall be subjected to a careful inspection immediately before installation.

C. If any defective pipe is discovered after it has been installed, the Contractor shall remove and replace it with a pipe in satisfactory condition at no additional expense to the Owner.

D. Ceramic epoxy and glass-lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

3.02 PIPE INSTALLATION

A. The Contractor shall provide and use proper implements, tools, and facilities for the safe and convenient performance of the work. All pipe, fittings, valves, and appurtenances shall be lowered carefully into the trench and at above-grade locations to prevent damage to the pipe, protective coating, lining, and polyethylene bagging. Under no circumstances shall pipeline materials be dropped off or dumped. A trench shall be dewatered before the pipe is installed. All buried ductile iron pipe, fittings, and in-line valves shall be bagged in polyethylene.

B. The Contractor shall carefully examine all pipe fittings, valves, and other appurtenances for damage and other defects immediately before installation and before bagging buried ductile-iron pipe. The Contractor shall mark and hold defective materials for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

C. The Contractor shall remove all lumps, blisters, and excess coating from the socket and plain ends of push-on joint pipe for buried service. The outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid in trench.

D. The Contractor shall prevent foreign material from entering the pipe while the pipe is being placed in the trench. During installation, no debris, tools, clothing, or other materials shall be placed in the pipe.

E. As each length of buried pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

F. When pipe is not being laid, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

G. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

H. Joint Assembly: Pipe joints shall be assembled in accordance with the manufacturer's instructions and the requirements of AWWA C600.

1. Flanged Joint: Before connecting flanged pipe the Contractor shall thoroughly clean all faces of the flanges of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to ensure proper sealing of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
2. Push-On, Restrained Joint, or Mechanical Joint: The Contractor shall joint piping in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstance.

I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane or where long radius curves are permitted, the amount of deflection shall not exceed that shown in AWWA C600 and that recommended by the retainer gland manufacturer for mechanical joint pipe and fittings.

J. Pipe Cutting: For inserting valves, fittings, or closure pieces pipe shall be cut in a neat, workmanlike manner without damaging the pipe or lining. Ductile cast iron 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 shall be ground smooth, and for push-on joint connections the cut end shall be beveled.

3.03 ABOVEGROUND PIPE INSTALLATION

A. The Contractor shall install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves, and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts in accordance with the pipe manufacturer's recommendations.

3.04 SURFACE PREPARATION AND PAINTING

A. All exposed pipe and fittings shall be painted as specified in Section 09900, Painting and Coating.

B. All buried steel bolts, nuts, washers, rods, harnesses, clamps, sleeves, and appurtenances shall be painted with System No. 21 as specified in Section 09900, Painting and Coating.

3.05 INSPECTION, TESTING, AND DISINFECTION

A. See Section 15055, Piping Systems—General; Section 15141, Disinfection of Piping and Water Storage Facilities; and Section 15144, Pressure Testing of Piping.

END OF SECTION

SECTION 15250
SMALL-DIAMETER PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide small-diameter pipe and fittings (nominal diameters less than 4 inches unless noted otherwise on the Drawings) as shown on the Contract Drawings and described in Section 15055, Piping Systems—General.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance, and Section 15055, Piping Systems—General.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A90/A90M—Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
3. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
4. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
5. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and other Special Purpose Applications.
6. ASTM A194/A194M—Standard Specification for CarbonSteel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
7. ASTM A312/A312M—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenistic Stainless Steel Pipes.
8. ASTM A320/A320M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.

9. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
10. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2464—Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
12. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
13. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
14. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM F439—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
16. ASTM F441/F441M—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
17. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
18. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

B. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standards.
3. ASME B16.11—Forge Fittings, Socket-Welding and Threaded.
4. ASME B18.2.1—Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
5. ASME B36.10M—Welded and Seamless Wrought Steel Pipe.
6. ASME B36.19M—Stainless Steel Pipe.

C. Plastic Pipe Institute (PPI)

1. PPI TR-31—Underground Installation of Polyolefin Piping.

D. National Sanitation Foundation (NSF)

1.04 QUALITY ASSURANCE

A. Piping materials and manufacturing shall adhere to the standards referenced in Section 15055, Piping Systems—General.

B. The Contractor shall strictly adhere to the manufacturer's written storage, handling, installation, and joining.

1.05 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15055, Piping Systems—General, for storing and protecting the items specified in this Section.

1.07 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. All pipe joints and fittings shall have the same schedule, pressure ratings, thermal resistance, chemical resistance, and other pertinent properties as the pipe being joined or connected. Plastic fittings shall be manufactured of the same resin as used in the manufacture of the pipe being joined.

B. Each pipe length shall be clearly marked with the manufacturer's name or trademark, applicable ASTM standards, size, pressure rating, and/or schedule.

C. Provide line size reducing tees for connecting lateral or instrumentation to pipe systems. Seal threaded fittings with Teflon™ tape or Teflon™ paste. Engage threaded fittings in accordance with ASTM A53/A53M.

D. All flange bolts, nuts, and washers shall be AISI Type 304 stainless steel, ASTM A193/A193M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex head nuts unless noted otherwise. Bolts shall be fabricated in accordance with ASME B18.2.1 and shall be provided with washers. Treat all bolts with anti-galling compound before assembly.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Pipe: ASTM D1785, manufactured from Class 12454-B rigid PVC compounds with a hydrostatic design stress of 13.8 MPa (2,000 psi) designated as PVC 1120.

Provide Schedule 40 PVC piping and socket welded fittings and Schedule 80 PVC threaded fittings, unless noted otherwise on the Drawings or in the Specifications.

B. Joints: Solvent-welded unless flanged or threaded joints are indicated on the Drawings or required for connection to equipment. Solvent cement shall be as specified in ASTM D2564 for PVC pipe and ASTM F493 for CPVC pipe.

C. Fittings:

1. Solvent-welded: ASTM D2466 or ASTM D2467, manufactured from Class 12454-B rigid PVC compound; solvent cement conforming to ASTM D2564. Solvent cement shall be as specified in ASTM D2564 for PVC pipe and ASTM F493 for CPVC pipe.
2. Threaded: ASTM D2464 manufactured from Class 12454-B rigid PVC compound; thread tape of Teflon. Only Schedule 80 PVC threaded pipe fittings shall be used.
3. Solvent-welded Sodium Hypochlorite Service: Solvent cement shall be IPS Weldon CPVC 724 or IPS EZ Weldon Wet R' Dry PVC 725, or approved equal.

D. Flanges: PVC Schedule 80 ANSI Class 150 flanges manufactured from rigid PVC compounds conforming to ASTM D1784.

1. Gaskets: Flat-face elastomer as specified and compatible for pipe system service. Viton gaskets shall be used for sodium hypochlorite service piping, valve flange faces, and fittings.
2. Bolts: AISI Type 304 stainless steel conforming to ASTM A320/A320M, Grade B. Titanium shall be used for sodium hypochlorite service piping, valve flanges, and fittings.

E. Unions: ASTM D2467 manufactured from Class 12454-B rigid PVC compound with elastomer o-rings as specified and compatible for service (viton for sodium hypochlorite service). Schedule 40 or 80 to match adjacent piping.

2.03 CHLORINATED POLYVINYL CHLORIDE PIPE (CPVC) AND FITTINGS:

A. Pipe: ASTM F441/F441M Schedule 80 manufactured from Class 23447-B Rigid CPVC Compounds with a hydrostatic design stress of 13.8 MPa (2,000 psi) designated as CPVC 1120.

B. Joints: All CPVC piping joints shall be Socket-Type unless otherwise indicated on the Drawings. Piping shall be solvent welded, threaded, or flanged.

C. Socket Type Fittings: ASTM F439 manufactured from Class 23447-B Rigid CPVC Compound.

2.04 GALVANIZED STEEL PIPE

A. Pipe: Steel piping shall conform to the requirements of ASTM A53/A53M, Type S, Grade B, and ASME B36.10M, Schedule 40 as indicated on the Contract Drawings.

B. Fittings: Forged steel conforming to ASTM A105/A105M and ASME B16.11, Class 2000.

C. Joints: Threaded conforming to ASME B1.20.1.

D. Galvanizing: Conform to ASTM A90/A90M.

2.05 STAINLESS STEEL PIPE

A. Stainless Steel Pipe—Threaded Joints: Conforming to ASTM A312/A312M, Grade TP 304 and 316, and ASME B36.19M, Schedule 40S.

1. Fittings: Conforming to ASTM A182/A182M, Grade F 304 and 316, and ASME B16.11 Class 2000, or Class 3000 where indicated on the Drawings or in the Specifications.
2. Threaded Joints: Conforming to ASME B1.20.1.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. The Contractor shall lay and maintain all pipes straight and true to line in conformance with the lines, grades, and elevations indicated on the Drawings. Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material.

B. Trenching, bedding, and backfill shall be in accordance with Section 02305, Earthwork for Utilities, and shall be installed in accordance with Section 15055, Piping Systems—General.

C. During laying operations, the Contractor shall not permit debris, tools, clothing, or similar items to be placed inside pipes. Pipe interior shall be free of mud and kept clean at all times. The Contractor shall secure the open ends of all piping at the end of construction each workday or any portion of a workday to prevent the intrusion of debris, precipitation, or soil from erosion. The proposed method of securing pipe open ends shall be approved by the Engineer. If the Contractor fails

to secure piping of if the secured end is dislodged, the Engineer shall require the Contractor to flush all affected piping to remove accumulated debris and verify that the piping is free of debris using a method acceptable to the Engineer, at no additional cost to the Owner.

D. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.

E. The Contractor shall be careful when lowering pipe into trenches or on subgrade to prevent damage or twisting of the pipe. After laying and before completing backfill or cover operations, pipe shall be protected from any vehicular traffic.

F. Existing piping flanged joints that are disassembled by the Contractor shall be fitted with new gaskets, as specified, upon reassembly.

3.02 PRESSURE AND LEAKAGE TESTS

A. Pressure Testing

1. The Contractor shall pressure test and leak test all new PVC, stainless steel, CPVC, and galvanized steel piping shown on the Drawings, the Flow Stream Identification Drawing, and Section 15055, Piping Systems—General, and Section 15144, Pressure Testing of Piping.

END OF SECTION

SECTION 15276
STAINLESS STEEL PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes materials and installation of stainless steel pipe and fittings 30 inches in diameter and smaller conforming to ASTM A312/A312M and having a maximum design pressure of 200 psi.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit materials list showing material of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM A53/A53M, ASTM A135/A135M, ASTM A587, AWWA C200. Show piping service (fuel oil, gasoline, water, air, etc.).

B. For piping 6 inches and larger, submit piping layout drawings showing locations and dimensions of pipe and fittings. Include laying lengths of valves, meters, in-line pumps, and other equipment determining piping dimensions. Label or number each fitting or piece of pipe and provide the following information for each item:

1. Material of construction, with ASTM or API reference and grade.
2. Wall thickness of steel cylinder.
3. Manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A53/A53M, ASTM A135/A135M, API SPEC 5L, AWWA C200.
4. Show weld sizes and dimensions of grooved-end collars, flanges, reinforcing collars, wrapper plates, and crotch plates.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A53/A53M—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
3. ASTM A125—Standard Specification for Steel Springs, Helical, Heat-Treated.
4. ASTM A135/A135M—Standard Specification for Electric-Resistance-Welded Steel Pipe.
5. ASTM A181/A181M—Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
6. ASTM A182/A182M—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
7. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
8. ASTM A312/A312M—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
9. ASTM A351—Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
10. ASTM A380/A380M—Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
11. ASTM A403/A403M—Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
12. ASTM A530/A530M—Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe.
13. ASTM A587—Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
14. ASTM A743/A743M—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
15. ASTM A774/A774M—Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
16. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.
17. ASTM F2015—Standard Specification for Lap Joint Flange Pipe End Applications.

B. American Petroleum Institute (API)

1. API SPEC 5L—Specification for Line Pipe.

C. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.1—Pipe Threads, General Purpose (Inch).
2. ASME B16.1—Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
3. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
4. ASME B16.9—Factory-Made Wrought Buttwelding Fittings.
5. ASME B16.11—Forged Fittings, Socket-Welding and Threaded.
6. ASME B16.25—Buttwelding Ends.
7. ASME B31.3—Process Piping.
8. ASME B36.19M—Stainless Steel Pipe.
9. ASME BPVD—ASME Boiler and Pressure Vessel Code.

D. American Welding Society (AWS)

1. AWS A5.4/A5.4M—Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding.
2. AWS A5.9/A5.9M—Welding Consumables – Wire Electrodes, Strip Electrodes, Wire, and Rods for Arc Welding of Stainless and Heat Resisting Steels – Classification.

E. American Water Works Association (AWWA)

1. AWWA C200—Steel Water Pipe – 6-Inch (150 mm) and Larger.
2. AWWA C220—Stainless Steel Pipe 1/2 Inch (13 mm) and Larger.
3. AWWA C606—Grooved and Shouldered Joints.
4. AWWA M11—Steel Pipe: A Guide for Design and Installation.

F. Manufacturers Standard Society (MSS)

1. MSS SP-83—Class 3000 and 6000 Pipe Unions, Socket Welding and Threaded (Carbon Steel, Alloy Steel, Stainless Steels, and Nickel Alloys).
2. MSS SP-97—Integrally Reinforced Forged Branch Outlet Fittings – Socket Welding, Threaded, and Buttwelding Ends.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 PIPE

A. Pipe smaller than 3 inches shall conform to ASTM A312/A312M, Grade TP 304L. Pipe 3 inches and larger shall conform to ASTM A312/A312M, Grade TP 304L.

B. Pipe sizes and wall thicknesses shall conform to ASME B36.19 as follows:

Pipe Size	Wall Thickness
1 inch and smaller	Schedule 80S
1-1/4 inches through 3 inches	Schedule 80S
3-1/2 inches through 8 inches	Schedule 40S

2.02 FITTINGS

A. Fittings 3 inches and smaller shall be socket welded, conforming to ASME B16.11, 3,000-pound CWP. Material for socket-welded fittings shall conform to ASTM A403/A403M, Class WP 304L or ASTM A182/A182M, Grade F304L.

B. Fittings for buried or submerged pipe larger than 3 inches through 24 inches shall be butt-welded, conforming to ASTM A403/A403M, Class WP or ASTM A774/A774M, the same material and wall thickness as the pipe, conforming to ASME B16.9. Elbows shall be long radius.

C. Fittings for aboveground or exposed pipe larger than 3 inches through 24 inches shall be butt-welded or flanged, conforming to ASTM A403/A403M, Class WP or ASTM A774/A774M, the same material and wall thickness as the pipe, conforming to ASME B16.9. Elbows shall be long radius.

2.03 PREPARATION AND FINAL CLEANING

A. Pipe and fittings shall be final cleaned, pickled, and passivated in accordance with ASTM A380/A380M. Passivation shall be the removal of exogenous (not inherent in the base metal) iron or iron compounds from the surface of the stainless steel by a chemical dissolution, a treatment with an acid solution that will completely remove the surface contamination but will not significantly affect the stainless steel itself. After final cleaning, wet surfaces with water and inspect for rust spots after 24 hours. Reclean if there is any evidence of rusting.

2.04 QUALITY CONTROL

A. Include the "Hydrostatic Test" and "Flattening Test" requirements described in ASTM A530/A530M.

2.05 PROTECTIVE END CAPS

A. The Contractor shall provide protective end caps on each piece of pipe or fabricated section, completely sealing the piece from contamination during shipment and storage. Provide the same type of seals on each fitting or ship and store fittings in sealed boxes or containers.

2.06 UNIONS

A. Unions shall be 3,000-pound WOG-forged stainless steel, with dimensions conforming to MSS SP-83. Ends shall be socket-welded type. Material shall conform to ASTM A182/A182M, Grade F304L for socket-welded type.

2.07 JOINTS

A. Joints for pipes 3 inches and smaller shall be socket welded, the same material as specified for fittings, 3,000-pound WOG, conforming to ASME B16.11.

B. Joints for buried or submerged pipe larger than 3 inches shall be butt-welded.

C. Joints for aboveground or exposed pipe larger than 3 inches shall be grooved end or flanged or butt-welded. Grooved-end joints for piping 24 inches and smaller shall be of the roll-grooved type.

D. Provide plain-end pipe where flexible pipe couplings are to be provided. Provide lugs for thrust harnesses where shown in the Drawings, as specified in Section 15122, Flexible Pipe Couplings and Expansion Joints.

E. Where piping connects to wall pipes, meters, valves, or other equipment, the pipe ends shall match the ends of the wall pipes, meters, valves, or equipment.

2.08 OUTLETS AND NOZZLES

A. Outlets of 3 inches and smaller in piping 4 inches and larger shall be of the Thredolet type, in accordance with MSS SP-97 and AWWA M11. Outlets shall be 3,000-pound WOG stainless steel in accordance with ASTM A182/A182M, Grade F304L F316L or ASTM A403/A403M, Grade WP304L WP316L. Threads shall comply with ASME B1.20.1. Outlets shall be Bonney Forge Co. "Thredolet," Allied Piping Products Co. "Branchlet," or equal.

B. Alternatively, threaded openings not less than 2 inches or more than 3 inches in nominal size shall be a flat-bottom half-coupling conforming to ASME B16.11, Class 3000. Where the mounting surface is curved to a diameter of 36 inches or less, the mounting diameter shall be the same as that of the surface upon which it is to be mounted. Forge the threaded outlet and its plug from steel conforming to ASTM A105/A105M or ASTM A181/A181M, Class 70.

C. For outlets 3 inches and smaller in piping smaller than 4 inches, use a tee with a threaded outlet.

D. For outlets larger than 3 inches, use a tee with a flanged outlet.

2.09 GROOVED-END COUPLINGS

A. Grooved-end couplings for piping 24 inches and smaller shall be Type 316 stainless steel. Couplings shall be flexible type, square-cut grooved, per AWWA C606. Couplings shall be Victaulic Style 77-S, Gustin-Bacon Figure 100, or equal.

B. Gaskets shall be CPDM and shall conform to ASTM D2000.

C. Bolts in exposed service shall conform to ASTM A193/A193M, Grade B8M, Class 2. Bolts in buried or submerged service shall be ASTM A193/A193M, Grade B8M, Class 2.

D. Couplings for connecting to grooved-end valves shall be Victaulic Style 75 to match the valve ends.

E. Grooved-end adapter flanges for pipe 18 inches and smaller having a maximum test pressure of 200 psi shall comply with ASME B16.1, Class 125 dimensions. Flanges shall be Victaulic Style 741 or 742, Gustin-Bacon Figure 154, or equal.

2.10 THREAD LUBRICANT

A. Use Teflon thread lubricating compound or Teflon tape.

2.11 FLANGES

A. The Contractor shall provide weld-neck flanges (conforming to ASME B16.5) for piping 3 inches and smaller to connect to flanged valves, fittings, or equipment. Provide weld-neck or Van Stone flanges (in accordance with ASTM F2015) for piping larger than 3 inches. Flanges shall be Class 150 in accordance with ASME B16.5. Flanges shall match the connecting flanges on the adjacent fitting, valve, or piece of equipment. Flanges shall be flat face.

B. Material for weld-neck flanges shall conform to ASTM A182/A182M, Grade F304L.

C. Material for Van Stone flanges shall be stainless steel conforming to ASTM A351, Grade CF8M.

2.12 BOLTS AND NUTS FOR FLANGES

A. See Section 15055, Piping Systems—General.

2.13 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

A. See Section 15055, Piping Systems—General.

2.14 GASKETS FOR FLANGES

A. See Section 15055, Piping Systems—General.

2.15 WYE STRAINERS

A. Strainers 2 inches and smaller shall be stainless steel, wye pattern, with minimum pressure rating of 300 psi WOG. Material shall conform to ASTM A351 or A743/A743M, Grade CF8M. Screen shall be 20 mesh and the same material as the strainer. Provide pet cock of the same material as the strainer body in the blowoff connection. Ends shall be threaded conforming to ASME B1.20.1. Provide one spare screen for each strainer. Strainers shall be Sarco Type 316, Muessco No. 861, or equal.

PART 3 EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION

A. Beveled ends for butt-welding shall conform to ASME B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

B. Fabrication shall comply with ASME B31.3, Chapter V. Welding procedure and performance qualifications shall be in accordance with Section IX, Articles II and III, respectively, of the ASME BPVC.

C. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	Minimum Number of Passes for Welds
Less than 0.1875	1
0.1875 through 0.25	2
Greater than 0.25	3

Welds shall be full penetration.

D. Use the shielded metal arc welding (SMAW) submerged arc welding (SAW), flux-cored arc welding (FCAW), or gas-metal arc welding (GMAW) process for shop welding. Use the SMAW process for field welding.

E. Welding preparation shall comply with ASME B31.3, Paragraph 328.4. Limitations on imperfections in welds shall conform to the requirements in ASME B31.3, Table 341.3.2, and Paragraph 341.4 for visual examination.

F. Identify welds in accordance with ASME B31.3, Paragraph 328.5.

G. Clean each layer of deposited weld metal before depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

H. Use an inert or shielding gas welding method. Do not use oxygen fuel welding. The interior of the pipe shall be purged with inert gas before the root pass.

I. Welded butt joints (both longitudinal and circumferential) shall comply with AWWA C220, Section 4. Do not use backing rings. Provide full penetration and smooth internal diameters for the root bead of welds. Grind the inside weld of socket welds flush with the pipe internal diameter. Welds shall be of smooth finish. Use anti-spatter compounds specifically formulated or designed for use

with stainless steel. Do not allow heat tint to form in the heat-affected zone or remove heat tint completely from the heat-affected zone of the finished weld. The maximum depth of grinding or abrasive blasting to remove defects shall not exceed 10% of the wall thickness. Do not perform abrasive blasting with steel shot, grit, or sand.

J. No iron or steel surfaces shall come into contact with the stainless steel. This includes placing the stainless steel on steel tables, racks, pipe supports, etc. Do not use carbon steel wire brushes or grinders.

K. Welding electrodes shall comply with AWS A5.4/A5.4M. Bare wire shall comply with AWS A5.9/A5.9M. Use electrodes as follows:

Pipe Material	Welding Electrode Material
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

3.02 SHOP TESTING OF FABRICATED OR WELDED COMPONENTS

A. After completion of fabrication and welding in the shop and before the application of any lining or coating, test each component according to the referenced standards. Test fabricated fittings as specified in AWWA C200. Test the seams in fittings which have not been previously shop hydrostatically tested by the dye penetrant method as described in ASME BPVC Section VIII, Appendix B. In lieu of the dye penetrant method of testing, completed fittings may be hydrostatically tested. Use the field hydrostatic test pressure or 125% of the design pressure, whichever is higher.

3.03 INSTALLING THREADED PIPING

A. Ream, clean, and remove burrs from threaded piping before making up joints. Apply thread lubricant to threaded ends before installing fittings, couplings, unions, or joints.

3.04 INSTALLING FLANGED PIPING

A. See Section 15055, Piping Systems—General.

3.05 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

A. See Section 15055, Piping Systems—General.

3.06 INSTALLING GROOVED-END PIPING

A. See Section 15055, Piping Systems—General.

3.07 INSTALLING UNIONS

A. Provide unions on exposed piping 3 inches and smaller as follows:

1. At every change in direction (horizontal and vertical).
2. Six to 12 inches downstream of valves.
3. Every 40 feet in straight piping runs.
4. Where shown in the Drawings.

3.08 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. See Section 15055, Piping Systems—General.

3.09 INSTALLING BURIED PIPING

A. Install in accordance with Section 02305, Earthwork for Utilities, and as follows.

B. When installing pipe in trenches, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert.

3.10 INSTALLING SUBMERGED PIPING

A. Install pipe on the alignment shown in the Drawings.

B. Do not add water into the basins while the pipe is empty.

3.11 FIELD HYDROSTATIC TESTING

A. The Contractor shall hydrostatically test pipe and fittings in the field in accordance with Section 15144, Pressure Testing of Piping. See Piping Schedule for test pressures.

B. Do not allow test water to remain in the pipe for more than 5 days. Drain and dry the piping after completing the testing.

3.12 PAINTING AND COATING

A. Coat exposed carbon steel grooved-end couplings and Van Stone flanges in accordance with Section 09900, Painting and Coating.

B. Coat submerged carbon steel grooved-end couplings and Van Stone flanges with System No. 7 as specified in Section 09900, Painting and Coating.

C. Coat buried carbon steel grooved-end couplings and Van Stone flanges with System No. 24 in accordance with Section 09900, Painting and Coating.

D. Do not coat stainless steel grooved-end couplings and Van Stone flanges.

E. Do not coat buried stainless steel piping.

3.13 COATING BURIED AND SUBMERGED BOLTS, NUTS, AND TIE RODS

A. See Section 15055, Piping Systems—General.

END OF SECTION

SECTION 15285
POLYVINYL CHLORIDE (PVC) DRAINAGE PIPING AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, equipment, and materials required to supply, install, and test (PVC) drainage piping and fittings, including accessories, as shown on the Drawings and/or specified in this Section and Section 02530, Pipework, Gravity Sewer.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance, and Section 15055, Piping Systems—General:

A. In general, shop drawings and related manufacturer's product certification shall be made in accordance with the General and Special Conditions of the Contract for approval before the manufacturer constructs or fabricates the material.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D1734—Standard Practice for Making Cementitious Panels for Testing Coatings.
2. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
3. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
4. ASTM D3034—Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fitting.
5. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
6. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

7. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
8. ASTM F1417—Standard Price for Installation Acceptance of Plastic Non-Pressure Sewer Lines Using Low-Pressure Air.
9. ASTM F1803—Standard Specification for Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.

1.04 QUALITY ASSURANCE

A. The Contractor shall submit to the Engineer written evidence that the pipe furnished under this Specification is in conformance with the material and mechanical requirements specified in this Section. Certified copies of independent laboratory test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel.

B. Each PVC closed profile wall pipe length and fitting shall be clearly marked with the following:

1. Manufacturer's Name.
2. Nominal Pipe Size.
3. Cell Classification.
4. ASTM F1803 Designation.
5. Pipe Stiffness – 46 psi.

C. All pipes shall be factory air tested with gasket in place and marked accordingly.

1.05 DELIVERY, HANDLING, AND STORAGE

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. The Contractor shall handle and store pipe in accordance with the manufacturer's written instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. Apart from structural voids and hollows associated with profile wall designs, the pipe and fittings shall be homogenous throughout and free from visible cracks,

holes, foreign inclusions, and other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.

B. Pipe cover shall be as shown on the Drawings.

C. All pipe, joints, fittings, and adapters shall be designed to withstand the forces imposed on the pipe by the soil cover and an AASHTO H-20 load.

2.02 PIPE

A. PVC profile wall pipe and fittings shall be manufactured in accordance with the requirements of ASTM F1803, latest edition.

B. PVC profile wall pipe shall be made from a compound meeting the requirements of cell classification 12364A as defined by ASTM D1784.

2.03 JOINTS

A. PVC profile wall pipe joints shall be the bell-and-spigot type with elastomeric seals and conform to the requirements of ASTM D3212.

B. Gaskets shall meet the requirements of ASTM F477 and be molded into a circular form or extruded to the proper section, and then spliced into circular form. Gaskets shall be made of a properly cured high-grade elastomeric compound.

C. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Field-installed gaskets and field-cut beveled lengths of pipe shall be done in accordance with the manufacturer's instructions and recommended equipment and materials.

D. The Contractor shall thoroughly clean and lubricate all pipe gaskets and spigots before assembly.

2.04 FITTINGS

A. All fittings shall be fabricated from pipe meeting the requirements of the standards above. Fabricated miter joints shall be reinforced by fusion heat welding.

2.05 D.I./PVC MECHANICAL JOINT ADAPTORS

A. The manufacturer of the PVC profile wall pipe shall supply all D.I./PVC mechanical joint adaptors and accessories required to perform the work as shown on the Drawings.

B. Joint restraints shall be provided to keep the connecting pieces from pulling apart.

2.06 LOCATOR WIRE

A. All PVC profile wall piping shall be installed with two insulated 12-gauge minimum AWG solid strand copper wires for location purposes as specified in Section 15055, Piping Systems—General.

PART 3 EXECUTION

3.01 GENERAL

A. Installation shall be in accordance with the recommendations contained in this Section and in the pipe manufacturer's installation guide. All applicable safety regulations shall be followed.

3.02 INSTALLATION REQUIREMENTS

A. All pipes shall be laid and maintained straight and true to line in conformance with the lines, grades, and elevations indicated on the Drawings. Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material.

B. Trenching, bedding, and backfill shall be in accordance with Section 02305, Earthwork for Utilities, and shall be installed in accordance with Section 15055, Piping Systems—General.

C. During laying operations, the Contractor shall not permit debris, tools, clothing, or similar items to be placed in pipes. Pipe interior shall be free of mud and kept clean at all times. The Contractor shall secure the open ends of all piping at the end of construction each work day or any portion of a work day to prevent the intrusion of debris, precipitation, or soil from erosion.

D. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.

3.03 INSPECTION AND TESTING

A. After any section of pipe is completed, the grades, joints, and alignment shall be true to line and grade. There shall be no visual leakage and the sewer shall be completely free from any cracks and from protruding joint materials, and deposits of sand, mortar, or other materials on the inside to the satisfaction of the Engineer.

B. The Contractor shall conduct air tests for leakage as determined by the Engineer. Testing shall be conducted in accordance with all applicable safety standards.

C. Air Test: Each section of sewer between two or more manholes shall be tested in accordance with ASTM F1417.

If any test fails to meet the established requirements, the Contractor shall determine the cause and correct if necessary.

D. At the Engineer's request the Contractor shall perform a deflection test. The deflection can be measured mechanically by a mandrel or manually using an extension ruler. The final deflection test shall not be made on a section of sewer until all the backfill on that section has been in place for 30 days.

The minimum acceptable diameter shall be as follows:

Pipe Size	Minimum Acceptable Diameter (in.)	
(in)	5% Test	7 ½% Test
21	19.11	18.61
24	21.65	21.08
27	24.41	23.77
30	27.18	26.46
36	32.71	31.85
42	38.23	37.22
48	43.61	42.47
54	48.98	47.69

All excess deflections shall be corrected. The Contractor shall correct the deficiency and retest the pipe.

3.04 CLEANUP

A. After completing each section of the sewer line, the Contractor shall remove all debris, construction materials, and equipment from the site of the work; grade and smooth over the surface on both sides of the line; and leave the entire right of way in a clean, neat, and serviceable condition.

END OF SECTION

SECTION 15290
PVC PIPE, 3 INCHES AND SMALLER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes materials, installation, and testing of PVC pipe and fittings of size 3 inches and smaller for use in process piping having a maximum design pressure of 150 psi and having a maximum design temperature of 105°F and at locations shown in the Drawings and as described on the Pipe Schedule presented in the Drawings.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall do the following:

1. Submit materials list showing materials of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM D1784, ASTM D1785, and ASTM D2467. Show wall thickness of pipe and fittings. Show fitting dimensions.
2. Submit data sheets for solvent cement and demonstrating compliance with ASTM D2564 and ASTM F656.
3. Submit data sheets showing that the pipe and fittings are NSF 61 listed for use in potable water service and that the pipe will bear the NSF logo for potable water use.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

2. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D2464—Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
4. ASTM D2467—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2774—Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
7. ASTM D2855—Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
8. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

B. American Society of Mechanical Engineers (ASME)

1. ASME B1.20.01—Pipe Threads, General Purpose (Inch).
2. ASME B16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.

C. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 PIPE

A. Pipe shall be Schedule 80, Type I, Grade 1 (Class 12454-B), conforming to ASTM D1784 and ASTM D1785.

B. Pipe shall bear the NSF logo for potable water use.

2.02 FITTINGS

A. Fittings shall be Schedule 80 and shall conform to ASTM D2464 for threaded fittings and ASTM D2467 for socket-type fittings.

2.03 FLANGES

A. PVC flanges shall be of the one-piece solid socket design and shall be made of the same material as the pipe. Pressure rating shall be at least 150 psi at a temperature of 73°F. Minimum burst pressure shall be 500 psi. Flanges shall match the dimensions of ASME B16.5, Class 150, steel flanges for outside diameter, bolt circle, and bolt holes. Do not use Van Stone flanges.

2.04 UNIONS

A. Unions shall have socket-type ends, Viton O-rings, and shall be Schedule 80. Material shall be Type I, Grade 1 PVC, in accordance with ASTM D1784.

2.05 JOINTS

A. Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to valves and equipment.

2.06 SOLVENT CEMENT IN OTHER THAN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE

A. Solvent cement for socket joints shall comply with ASTM D2564 and ASTM F656.

2.07 SOLVENT CEMENT IN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE

A. Solvent cement shall be free of silica. Products: IPS “Weld-On 724” or Oatey “Lo V.O.C. PVC Heavy Duty Gray.”

2.08 GASKETS FOR FLANGES

A. See Section 15055, Piping Systems—General.

2.09 BOLTS AND NUTS FOR FLANGES

A. See Section 15055, Piping Systems—General.

2.10 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

A. See Section 15055, Piping Systems—General.

2.11 WYE STRAINERS

A. PVC wye strainers shall be manufactured of the same material as the pipe, with 30-mesh screens and Viton seals. Connecting ends shall be the socket type, solvent welded. Provide one spare screen for each strainer.

PART 3 EXECUTION

3.01 GENERAL

The Contractor shall adhere to the following:

A. Do not install PVC pipe when the temperature is below 40°F or above 90°F. Store loose pipes on racks with a maximum support spacing of 3 feet. Provide shade for pipe stored outdoors or installed outdoors until the pipe is filled with water.

B. Store fittings indoors in their original cartons.

C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements that have exceeded the shelf life marked on the storage container.

D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.

E. Do not drag PVC pipe over the ground, drop it onto the ground, or drop objects on it.

3.02 SOLVENT-WELDED JOINTS

A. Before solvent welding, remove fittings and couplings from their cartons and expose them to the air at the same temperature conditions as the pipe for at least 1 hour.

B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent-welded pipe ends as recommended by the pipe manufacturer.

C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent cement. Clean the surfaces of both pipes and fittings that are to be solvent welded with a clean cloth moistened with acetone or methylethyl ketone. Do not apply solvent cement to wet surfaces.

D. The pipe and fitting socket shall have an interference fit. The diametrical clearance between pipe and entrance of the fitting socket shall not exceed 0.04 inch. Check the fit at every joint before applying solvent cement.

E. Make up solvent-welded joints in accordance with ASTM D2855. Application of cement to both surfaces to be joined and assembly of these surfaces shall produce a continuous bond between them with visual evidence of cement at least flush with the outer end of the fitting bore around the entire circumference.

F. Allow at least 8 hours of drying time before moving solvent-welded joints or subjecting the joints to any internal or external loads or pressures.

G. Acceptance criteria for solvent-welded joints shall be as follows:

1. Unfilled Areas in Joint: None permitted.
2. Unbonded Areas in Joint: None permitted.
3. Protrusion of Material into Pipe Bore, Percent of Pipe Wall Thickness: Cement, 50%.

3.03 FLANGED JOINTS

A. Lubricate carbon steel bolt threads with graphite and oil before installation.

B. Tighten bolts on PVC flanges by tightening the nuts diametrically opposite each other using a torque wrench. Complete tightening shall be accomplished in stages and the final torque values shall be as shown in the following table:

Pipe Size (inches)	Final Torque (foot-pounds)
1/2 to 1-1/2	10 to 15
2 to 3	20 to 30

3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

A. See Section 15055, Piping Systems—General.

3.05 THREADED JOINTS

A. Cut threaded ends on PVC to the dimensions of ASME B1.20.1. Ends shall be square cut. Follow the pipe manufacturer's recommendations regarding pipe hold-down methods, saw cutting blade size, and saw cutting speed.

B. Pipe or tubing cutters shall be specifically designed for use on PVC pipe. Use cutters manufactured by Reed Manufacturing Company, Ridge Tool Company, or equal.

C. If a hold-down vise is used when the pipe is cut, insert a rubber sheet between the vise jaws and the pipe to avoid scratching the pipe.

D. Thread cutting dies shall be clean and sharp and shall not be used to cut materials other than plastic.

E. Apply Teflon® thread compound or Teflon® tape lubricant to threads before screwing on the fitting.

3.06 INSTALLING UNIONS

A. Provide unions on exposed (above grade and in vaults) piping 3 inches and smaller as follows:

1. At every change in direction (horizontal and vertical).
2. Six to 12 inches downstream of valves.
3. Every 40 feet in straight pipe runs.
4. Where shown on the Drawings.

3.07 INSTALLING BURIED PIPE

A. Install in accordance with Section 02305, Earthwork for Utilities, and as follows.

B. Trench bottom shall be continuous, smooth, and free of rocks. See the details on the Drawings for trench dimensions, pipe bedding, and backfill.

C. After the pipe has been solvent-welded and the joints have set, snake the pipe in the trench according to the pipe manufacturer's recommendations to allow for thermal expansion and contraction of the pipe.

D. Do not backfill the pipe trench until the solvent-welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable soil. Do not use blocking to change pipe grade or to support pipe in the trench.

E. Install buried PVC pipe in accordance with ASTM D2774 and the pipe manufacturer's recommendations. Backfill materials in the pipe zone shall be imported sand as specified in Section 02305, Earthwork for Utilities. If water flooding is used, do not add successive layers unless the previous layer is compacted to 90% relative compaction.

3.08 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. See Section 15055, Piping Systems—General.

B. Fill empty piping with water, provide temporary shading, or use other means to keep the surface temperature of the pipe below 100°F.

3.09 PAINTING AND COATING

A. Coat piping that is exposed to sunlight as specified Section 09900, Painting and Coating.

3.10 PIPE LABELS AND COLOR CODING

A. Label and color code exposed piping and piping inside concrete pipe trenches with flow stream identification labels and banding in accordance with Section 15075, Process Equipment, Piping, and Valve Identification, and the Piping Schedule on the Drawings.

3.11 HYDROSTATIC TESTING

A. Perform hydrostatic testing for leakage in accordance with Section 15144, Pressure Testing of Piping.

END OF SECTION

SECTION 15291
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers the work necessary to furnish, install, and complete the AWWA C900 DR 18 PVC pipe and ductile iron fittings specified.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. All PVC pipe and fittings to be installed under this Contract shall be inspected and tested at the location where the material for this project is manufactured. The Contract shall submit certificates of such tests and their results.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable Sections of the Specifications.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society of Testing Materials (ASTM)

1. ASTM A242/A242M—Standard Specification for High-Strength Low-Alloy Structural Steel.
2. ASTM A536—Standard Specification for Ductile Iron Castings.
3. ASTM D2241—Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
4. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

B. American Water Works Association (AWWA)

1. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch Through 60-Inch (100 mm Through 1,500 mm).

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LARGE PVC PRESSURE PIPE

A. Large PVC Pressure Piping

1. Unless otherwise noted, PVC pressure pipe for nominal diameters 4 inches and larger shall conform to the requirements of AWWA C900 DR 18 up to 12 inches with piping larger than 12 inches having gasketed integral bell ends. Pipe shall be designed for maximum working pressure of not less than 150 psi. Pipe shall be made to ductile iron pipe ODs instead of IPS. The PVC pipe shall be blue and NSF approved for potable water use, green for wastewater use, and purple for reclaimed water use.

B. Bell and Spigot

1. 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 a factory glued rubber ring gasket that conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477. PVC joints shall be "Ring-Tite" as manufactured by J-M Manufacturing Company, Inc. or an equal approved by the Engineer. Nontoxic gasket lubricant shall be as specified by the pipe manufacturer.

C. Restrained Joints

1. The following pipe joints and fittings restraint methods can be used to prevent pipe joints and fittings from separating under pressure. No additional financial compensation will be provided to the Contractor for providing the following methods of restraint:

a. C-900 PVC pipe bell and spigot joints (4-inch- through 12-inch-diameter pipe) shall be restrained with the EBAA Iron MEGALUG® Series 1600 Restrainer or an equal approved by the Engineer. The Series 1600 restrainers shall provide a minimum of 150 psi restraint to DR 18 (Class 150) pipe with a 3 to 1 safety factor. C-905 PVC pipe bell and spigot shall be restrained with the EBAA Iron MEGALUG® Series 2800 Restrainer or an equal approved by the Engineer. The Series 2800 restrainers shall provide a minimum of 200 psi restraint to DR 18 (Class 235) pipe with a 2-to-1 safety factor. 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/A242M.

b. Mechanical joint fittings used with PVC pipe (3-inch- through 36-inch-diameter DR 18 pipe) shall be restrained with the EBAA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved by the Engineer. The Series 2000 PV restrainers shall provide a minimum of 150 psi restraint with a 2 to 1 safety factor. 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/A242M.

c. All parts of the joint restraint systems shall be coated with coal tar epoxy as in Section 09900, Painting and Coating, Mega-Bond coating system by EBAA Iron, Inc. or Engineer-approved equal.

2.02 LARGE PVC PRESSURE PIPE FITTINGS

A. Fittings for use with large PVC pipe shall be ductile-iron fittings conforming to the requirements of mechanical joint fittings as specified in Section 15155, Ductile Iron Pipe and Fittings.

B. Exterior Coating

1. Exterior coating for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.

C. Lining

1. Lining for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
2. Any damaged lined areas shall be repaired in accordance with the manufacturer's recommendations so that the repaired area is equal to the undamaged lined areas.

2.03 SMALL PVC PRESSURE PIPE

A. See Section 15250, Small-Diameter Piping, for Schedule 40 and Schedule 80 PVC pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall examine pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard may be performed to ensure conformance with the standard.

3.02 PIPE INSTALLATION

A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench using suitable tools or equipment to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered before installing the pipe in accordance with the Specifications.

B. The sealing surface of the pipe, the inside of the bell, and the inside of the gasket shall be cleaned immediately before assembly.

C. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.

D. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

E. At all times when pipe laying is in progress, except when joining another piece of pipe, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer to prevent the entrance of objectionable materials. Care shall be taken to prevent pipe flotation.

F. Trench width at the top of the pipe, bedding conditions, and backfill placement and compaction shall be in accordance with the Contract Documents.

G. Joint Assembly

1. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

H. Pipe Deflection

1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, the amount of deflecting shall not exceed 75% of that recommended by the manufacturer.

I. Pipe Cutting

1. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis.
2. Burrs shall be removed from spigots, and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

J. Thrust Restraint

1. All pipe, tees, valves, bends, etc., unless otherwise specified, shall be restrained using mechanical means as specified. Pipe restraint using the specified mechanical restraining system with the restrained joint schedule or tie-rods is also acceptable. Reaction blocking shall not be used on this project.
2. All ductile iron fittings, valves, mechanical restraint harnesses, and other forms of mechanical restraint shall be installed and wrapped in polyethylene tube material as specified in Section 15155, Ductile Iron Pipe and Fittings.

3.03 LOCATION AND IDENTIFICATION

A. All non-metallic reclaimed water**,** potable water**,** and sewer mains shall be installed with a continuous, insulated 14-gauge copper wire installed directly on top of pipe for location purposes. Detectable tape may be used in lieu of copper wire and shall be placed 1 foot above the top of the pipe.

B. All PVC reclaimed water mains shall be a solid pantone purple 522C color (in accordance with FDEP 62-610.469). All potable water mains shall be a solid blue color. All wastewater mains shall be a solid green color. All lettering shall appear legibly on the pipe and shall run the entire length of the pipe. Lettering shall be appropriate for the intended use.

C. All DIP reclaimed water mains shall be marked with a continuous stripe within the top 90º of the pipe, shall be a minimum of 2 inches in width, and shall be pantone purple 522C in color. Backfill shall not be placed for 30 minutes following paint application.

3.04 TESTING

A. All lines shall be tested at the pressures listed in the Process Pipe Flow Stream Identification and Schedule in the Contract Drawings.

B. See Section 15144, Pressure Testing of Piping, for the requirements of pipe flushing, cleaning, pressure and leakage testing, and inspection requirements.

C. See Section 15141, Disinfection of Piping and Water Storage Facilities, for the disinfection requirements.

END OF SECTION

SECTION 15294
CPVC WASTE DRAINPIPE, 4 INCHES AND SMALLER

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section describes materials, installation, and testing of chlorinated polyvinyl chloride (CPVC) waste drainpipe and fittings of size 4 inches and smaller for use in chemical system gravity drain applications.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Materials list showing materials of pipe and fittings with ASTM reference and grade. The Contractor shall submit the manufacturer's certification of compliance with referenced standards, e.g., ASTM D3311, ASTM F1412, and ASTM F439. Show wall thickness of pipe, fittings, and fitting dimensions.

B. Certification of compliance with NSF International for use in corrosive waste drainage systems as a Special Engineered (SE) product and bears the NSF mark.

C. Certificate of compliance with NSF 14.

D. Data sheets for solvent cement and demonstrating compliance with ASTM F493.

E. List of installations.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

2. ASTM D2774—Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
3. ASTM D3311—Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
4. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
5. ASTM F1412—Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.

B. NSF International (NSF)

1. NSF 14—Plastics Piping System Components and Related Materials.

1.04 WARRANTIES

A. Warranties shall be in accordance with Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

A. The CPVC waste drainage system shall be manufactured from CPVC Type IV, ASTM Cell Classification 23447. The CPVC waste drainage system shall be certified by NSF International for use in corrosive waste drainage systems as an SE product and shall bear the NSF mark. The CPVC waste drainage system shall be supplied by one manufacturer as a complete system including but not limited to the pipe, fittings, solvent cement, floor drains, and cleanouts.

2.02 PIPE

A. Pipe shall be Schedule 40 CPVC and shall conform to ASTM D1784, Cell Class 23447 and ASTM F1412, Sections 6.1, 6.8, 6.9, and 7. Pipe shall be CAN/ULC S102.2 listed for flame spread and smoke development with rating

designated on the pipe marking. Pipe markings shall be accompanied by a yellow stripe for identifying CPVC chemical waste system.

2.03 FITTINGS

A. Fittings shall be CPVC drainage patterns and shall meet the requirements of ASTM D3311 and ASTM F1412, Section 6.2. Fittings shall be CAN/ULC S102.2 listed for flame spread and smoke development with rating designated on the fittings of the original package label.

2.04 JOINTS

A. Pipe and fitting joints shall be socket-cemented in accordance with ASTM F493.

2.05 SOLVENT CEMENT

A. Solvent cement shall conform to ASTM F493 and shall be free of silica and formulated for chemical use. Products: IPS “Weld-On” 724 or Oatey “Lo V.O.C. CPVC Heavy Duty Gray.”

2.06 FLOOR DRAINS AND CLEANOUTS

A. Floor drains shall be CPVC Grate and Floor Drain with integral seep ring. Provide CPVC sediment trap with each floor drain. Sediment traps shall have 1/8-inch-diameter perforated strainer openings. Floor cleanouts shall have standard 5-inch-diameter CPVC covers. Provide membrane plate with floor drains and cleanouts in locations where chemical-resistant coatings are required to allow for attachment of flexible membranes associated with chemical-resistant coating systems.

2.07 MANUFACTURER

A. The CPVC waste drain system shall be Lab Waste CPVC Corrosive Waste Drainage System by Spears Manufacturing Company or equal.

PART 3 EXECUTION

3.01 GENERAL

The Contractor shall adhere to the following:

A. Do not install CPVC pipe when the temperature is below 40°F or above 90°F. Store loose pipes on racks with a minimum support spacing of 3 feet. Provide

shades for pipe stored outdoors or installed outdoors until the pipe is filled with water.

B. Store fittings indoors in their original cartons.

C. Store solvent cement indoors or, if outdoors, shade from direct sunlight. Do not use solvent cements that have exceeded the shelf life marked on the storage container.

D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.

E. Do not drag CPVC pipe over the ground, drop it onto the ground, or drop objects onto it.

3.02 SOLVENT-WELDED JOINTS

A. Before solvent welding, remove fittings and couplings from their cartons and expose them to the air for at least 1 hour and to the same temperature conditions as the pipe.

B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent-welded pipe ends as recommended by the pipe manufacturer.

C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent cement. Clean the surfaces of pipes and fittings that are to be solvent-welded with a clean cloth moistened with acetone or methylethyl ketone. Do not apply solvent cement to wet surfaces.

D. The pipe and fitting socket shall have an interference fit. The diametrical clearance between pipe and the entrance of the fitting socket shall not exceed 0.04-inch. Check the fit at every joint before applying solvent cement.

E. Make up solvent-welded joints in accordance with ASTM F493, Appendix X1. Application of cement to both surfaces to be joined and assembly of these surfaces shall produce a continuous bond between them with visual evidence of cement at least flush with the outer end of the fitting bore around the entire circumference.

F. Allow at least 8 hours of drying time before moving solvent-welded joints or subjecting the joints to any internal or external loads or pressures.

G. Acceptance criteria for solvent-welded joints shall be as follows:

1. Unfilled Areas in Joint: None permitted.
2. Unbonded Areas in Joint: None permitted.
3. Protrusion of Material into Pipe Bore, Percent of Pipe Wall Thickness: Cement, 50%.

3.03 INSTALLING BURIED PIPE

A. Install in accordance with Section 02305, Earthwork for Utilities, and as follows.

B. Trench bottom shall be continuous, smooth, and free of rocks. See the details on the Drawings for trench dimensions, pipe bedding, and backfill.

C. After the pipe has been solvent-welded and the joints have set, snake the pipe in the trench in accordance with the pipe manufacturer's recommendations to allow for thermal expansion and contraction of the pipe.

D. Do not backfill the pipe trench until the solvent-welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable soil. Do not use blocking to change pipe grade or to support pipe in the trench.

E. Install buried CPVC pipe in accordance with ASTM D2774 and the pipe manufacturer's recommendations. Backfill materials in the pipe zone shall be imported sand as specified in Section 02305, Earthwork for Utilities. If water flooding is used, do not add successive layers unless the previous layer is compacted to 90% relative compaction.

3.04 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. See Section 15055, Piping Systems—General.

3.05 PAINTING AND COATING

A. Coat exposed piping in accordance with Section 09900, Painting and Coating.

3.06 HYDROSTATIC TESTING

A. Perform hydrostatic testing for leakage in accordance with Section 15144, Pressure Testing of Piping.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050
ELECTRICAL—GENERAL PROVISIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required for a complete electrical system as hereinafter specified and shown on the Drawings, whether or not specifically shown or called for.
2. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter an/or shown on the Drawings. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, generator, lighting systems, instrumentation, wiring and control systems as indicated on the Drawings and/or as specified herein whether or not specifically shown or called for. Certain equipment will be furnished as specified in other sections of these Specifications, which will require conduit and wire to complete the installation as required.
3. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices (surge protection), conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.
4. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
5. Provide permitting and acceptance testing.
6. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.
7. For process instrumentation furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators and receivers. Coordinate wire termination with the instrumentation supplier.
8. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material, equipment, appliances and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.

9. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the existing building and/or proposed site in which work will take place and be performed to inspect carefully the present installation and conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing his work.
10. All necessary temporary power requirements are the responsibility of the Contractor and shall be furnished at to extra cost to the Owner.
11. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

B. Codes, Inspections and Fees

1. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.
2. Pay all fees required for permits, inspections, and connections.

C. Tests

1. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

D. Interpretation of Drawings

1. The Drawings are not intended to show exact location, quantity or size of conduit runs. All installation of the raceway system shall be as directed by approved shop drawing. Any installation of a raceway system before shop drawing submittal and approval will at the sole risk of the Contractor.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
4. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
5. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required

to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

6. Verify with the Engineer exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
7. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and, in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
8. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
9. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.
10. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can be determined in advance of the purchases of the equipment.
11. All connections to equipment shall be made as shown, specified, required, and directed and in accordance with the approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

E. Size of Equipment

1. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
2. The equipment shall be kept upright at all times. When equipment has to be tilted for each of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

F. Component Interconnections

1. Component equipment furnished under this Specification will not be furnished as integrated systems.

2. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

G. Record Drawings

1. As the work progresses, legibly record all field changes on a set of project Contract Drawings. When the project is complete furnish a complete set of reproducible "as-built" drawings for the Project Record Documents, Section 01785, Record Documents.

1.02 SUBMITTALS

A. Material and Shop Drawings

1. As specified under Section 01330, Submittals and Acceptance, shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.

2. Shop drawings shall be submitted for the following equipment:

a. Motor Control Centers.
b. Disconnect Switches.
c. Wire and Cable.
d. Supporting Devices.
e. Variable Frequency Drives.
f. Test Data.
g. Generator.

3. The manufacturers' name and product designation or catalog numbers shall be submitted for the following material:

a. Conduit.
b. Receptacles.
c. Boxes and Fittings.
d. Switches.
e. Lamps.
f. Control Relays.

4. Prior to submittal by the Contractor, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

5. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

6. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

7. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

B. Manufacturer's Services

1. Provide manufacturer's services for testing and start-up of the following equipment:

   a. Motor Control Centers.
   b. Variable Frequency Drives.
   c. Generator.

2. Provide manufacturer's of the above listed equipment shall provide an experienced Field Service Engineer to accomplish the following tasks:

   a. The equipment shall be visually inspected upon completion of installation and prior to energizing to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.
   b. The Field Service Engineers shall provide engineering support during the energizing and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.

c. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.

d. Three 4-hour training sessions (one for each system) on operation, and two 4-hour training sessions (one for each system) on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The maintenance and trouble-shooting sessions shall be conducted with record *as-built* electrical drawings sufficient for a class of eight personnel.

e. A final report shall be written and submitted to the Contractor within fourteen days from completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. 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. Samples of materials or manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc., listed.

C. 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 by the Contractor at his own cost and expense. 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, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

D. Surface mounted raceways and boxes mounted on tanks. Tanks walkways shall be stainless steel as noted on drawings. All fasteners shall be type 316 stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and place all sleeves for conduits penetrating floors, walls, partition, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. All cutting and patching shall be done in a thoroughly workmanlike manner.

3.02 INSPECTION AND TESTING

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

END OF SECTION

SECTION 16060
POWER DISTRIBUTION SYSTEM COORINDATION STUDY

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope

1. The Contractor shall provide all labor, materials, equipment, services, and incidentals required to perform Power System Studies and distribution system field testing.

B. The Power System Studies shall include a Short Circuit Study, a Protective Device Evaluation Study, Arc Flash Study, and a Protective Device Coordination Study for a completely coordinated Power Distribution System.

1.02 REFERENCES

A. Standards referenced in this Section are listed below:

1. American National Standards Institute (ANSI)

a. ANSI C37.04, Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.
b. ANSI C37.010, Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Basis.

2. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 141, Electric Power Distribution in Industrial Plants.
b. IEEE 399, Recommended Practice for Industrial and Commercial Power System Analysis.

3. National Electrical Code (NEC)

1.03 QUALITY ASSURANCE

A. Source Quality Control

1. Retain the services of a Registered Professional Engineer to perform the Power System Studies and field services. The Registered Professional

Engineer shall be from an independent consulting firm or from the manufacturer of the power distribution equipment.

2. Coordinate with the Engineer performing the studies and assist him in the collection.
3. All information pertaining to the existing system necessary to perform the studies shall be obtained in advance before performing the studies.
4. All motor starting and transformer information shall be based upon the equipment installed distribution system. The Field Engineer shall be from the manufacturer of the power distribution equipment.
5. The Studies shall use the existing working SKM model provided by the Owner.

B. All test equipment and instrument calibration shall be in accordance with the latest edition of the accuracy standard of the US National Institute of Standards and Technology.

1.04 SUBMITTALS

A. Shop Drawings – Submit the following:

1. Copies of calculations and results of the Short Circuit Study, Protective Device Evaluation, and Coordination Studies in a report format. The report shall be stamped and signed by the Registered Professional Engineer.
2. Work sequence for the field testing shall be submitted in advance before performing tests. The sequence shall indicate the schedule of work, time frame, and downtime for the equipment.
3. Time current curves for all protective devices included within the power system studies.

B. Reports

1. Field test report shall be submitted.

PART 2 PRODUCTS

2.01 POWER SYSTEM STUDIES

A. General

1. Provide a current and complete Short Circuit Study, Protective Device Evaluation Study, and a Protective Device Coordination Study for the Electrical Distribution System.

2. The studies shall include all portions of the high- and low-voltage electrical distribution system from the normal and alternate sources of power through the low-voltage distribution system. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions shall be thoroughly covered in the study.
3. Problem areas or equipment inadequacies shall be promptly brought to the Engineer’s attention.

B. Short Circuit Study

1. The Short Circuit Study shall be performed with the aid of a computer program.
2. The study input data shall include the utility company's short circuit, single- and three-phase contributions with the X/R ratio, the resistance and reactance components, and all other applicable circuit parameters.
3. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.
4. The short circuit tabulations shall include symmetrical fault currents and X/R ratios. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch including motor back EMF current contributions, shall be listed with its respective X/R ratio.

C. Protective Device Evaluation Study

1. A Protective Device Evaluation Study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents.
2. Appropriate multiplying factors based upon system X/R ratios and protective device rating standards shall be applied.

D. Protective Device Coordination Study

1. A Protective Device Coordination Study shall be performed to select or to check the selections of the power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings.

2. The overcurrent device settings computed in the Protective Device Coordination Study shall provide complete 100-percent selectivity. The

system shall be selectively coordinated such that only the device nearest a fault will operate to remove the faulted circuit. This shall be based on both the magnitude and the duration of a fault current.

3. The Protective Device Coordination Study shall include all voltage classes of equipment starting at the utility's incoming line protective device down to and including each of the medium- and low-voltage equipment. The phase and ground overcurrent and the phase and ground fault protection shall be included as well as settings for all other adjustable protective devices.

4. The time-current characteristics of the installed protective devices shall be plotted on the appropriate log-log paper. Reasonable coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase- and ground-protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate selective coordination achieved through the utility main breaker, power distribution feeder breakers, and the overcurrent devices at each major load center.

5. There shall be a maximum of eight protective devices per plot. Each plot shall be appropriately titled. Plots shall include the following information as required for the circuits shown:

    a. Representative one-line diagram, legends, and types of protective devices selected.
    b. Power company’s relays or fuse characteristics.
    c. Significant motor starting characteristics.
    d. Parameters of transformers, ANSI magnetizing inrush, and withstand curves.
    e. Operating bands of low-voltage circuit-breaker trip curves and fuse curves.
    f. Relay taps, time dial, and instantaneous trip settings.
    g. Cable damage curves.
    h. Symmetrical and asymmetrical fault currents.

6. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system.

E. Arc Flash Hazard Study

1. An Arc Flash Hazard Study shall be performed for the electrical distribution system shown on the one-line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one-line drawing. This includes switchgear, switchboards, panelboards, motor control centers, and transformers. The Study shall include creation of Arc Flash Hazard Warning Labels listing all items. The Contractor will install the labels. The Arc Flash Hazard Study shall consider all operating scenarios during normal conditions, alternate operations, emergency power conditions, and any other operations that could result in maximum arc flash hazard.

2.02 STUDY REPORT

A. The results of the Power Distribution System Coordination Study shall be summarized in a final typewritten report. The report shall include the following sections:

1. Description, purpose, basis, written scope, and a single-line diagram of the Power Distribution System that is included within the scope of the study.
2. Tabulations of circuit breaker, fuses, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.
3. Protective device time versus current coordination curves, tabulations of relay and circuit-breaker trip settings, fuse selection, and commentary regarding same.
4. Fault current tabulation including a definition of terms and a guide for interpretation.
5. Tabulation of appropriate tap settings for relay seal-in units.
6. Tabulation of equipment survey information.

PART 3 EXECUTION

3.01 FIELD SERVICES

A. The Registered Professional Engineer shall conduct an equipment survey of devices and information necessary to perform the Power System Studies.

B. The survey shall include the following information to the extent applicable:

1. Manufacturer, type, and size of each power fuse.
2. Manufacturer, type, model, and settings for each protective relay, trip unit, and circuit breaker.

3. Current transformer ratios for each protective relay.
4. Appropriate data of motors and transformers included with the Study.

C. The Registered Professional Engineer, as part of the field service work, shall collect all data and coordinate with the equipment vendors to establish the proper settings for the actual devices provided.

3.02 FIELD TESTING

A. Provide field testing of the distribution system in accordance with the manufacturer's recommendations. All field testing shall be performed by the Field Engineer after the completion and approval of the Power System Studies. The field-testing results shall be documented in a report with the final settings of all protective devices.

B. The Field Engineer, with necessary tools and equipment, shall adjust, set, calibrate, and test all protective devices. All protective relays and meters in the medium- and low-voltage equipment shall be set, adjusted, calibrated, and tested in accordance with the manufacturer's recommendations, the Coordination Study, and best industry practice.

C. Proper operation of all equipment associated with the device under test and its compartment shall be verified, as well as complete resistance, continuity, and polarity tests of power, protective, and metering circuits. Any minor adjustments, repairs, and lubrication necessary to achieve proper operation shall be considered part of this Contract.

D. All solid-state trip devices shall be set including all required programming necessary for the protection required. The devices shall be checked and tested for setting and operation. Circuit breakers and/or contactors associated with the trip devices shall be tested for trip and close function with their protective device.

3.03 MAINTENANCE OF OPERATIONS

A. Since the field-testing work specified may require that certain pieces of equipment be taken out of service, the Contractor shall perform the Work with due regard to maintenance of operations and construction staging in accordance with the requirements of this Section with the Owner's operation. All testing procedures and schedules must be scheduled in advance before any work begins.

END OF SECTION

SECTION 16110
RACEWAYS AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. The complete above grade raceway system shall be rigid aluminum and PVC-40 below grade.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

B. Standards

1. Underwriters Laboratories, Inc. (UL).
2. American Society for Testing and Materials, (ASTM).
3. Federal Specifications.

C. Manufacturers

1. Non-Metallic Raceways.

   a. Carlon.
   b. Triangle Pipe and Tube Co.
   c. Phillips Petroleum Co.
   d. Indian Head Company.
   e. Or equal.

2. Metallic Raceways:

   a. Youngstown Sheet and Tube Co.

b. Allied Tube and Conduit Corp.
c. Wheeling-Pittsburg Steel Corp.
d. Or equal.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

a. Certified shop drawings with performance data and physical characteristics.
b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
c. All information required by Section 01330, Submittals and Acceptance.
d. A complete total bill of materials for all equipment.

2. In the event that it is impossible to conform with certain details of the specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

PART 2 PRODUCTS

2.01 GENERAL

A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.

B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Metallic Conduit

1. ALUM conduit shall contain less than 0.1 percent copper and conform to Federal Specification WW-C-540C.

B. Non-Metallic Conduit and Fittings

1. PVC conduit shall be schedule 80 composed of High Impact PVC (polyvinyl) chloride (C-200 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 psi, at 70 degrees F, flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have 5 years' extruding PVC experience.
2. Liquidtight Flexible Conduit and Fittings shall be for use per Article 351 of the NEC. PVC compounds shall not include fillers. Fittings shall be manufactured from high impact PVC.

C. Liquidtight, Flexible Non-Metallic Conduit, Couplings and Fittings

1. Liquidtight, flexible non-metallic conduit shall be all PVC conduit and manufactured by Thomas and Betts Co., K-Flex, Inc., or equal.
2. Fittings used with Liquidtight flexible conduit shall be aluminum.

D. Flexible Couplings

1. Flexible Couplings shall be as manufactured by the Thomas and Betts Co., K-Flex, Inc., or equal.

E. Conduit hubs shall be aluminum as manufactured by Myers Electric Products, Inc., Raco,, Div., Appleton Electric Co., or equal.

F. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. O., or equal.

G. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendation, in the location shown on the Drawings.

B. No conduit smaller than 1/2-inch electrical trade size shall be used, nor any have more than three 90-degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size floor conduit shall be 3/4-inch.

C. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

D. The ends of all conduit shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

E. Conduit supports shall be spaced at intervals of 4 feet or less, as required to obtain rigid construction. Conduit straps shall be type as manufactured by "CLIC".

F. Single conduits shall be supported by means of one-hole non-metallic pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with fiberglass horizontal members and fiberglass treaded hanger rods. The rods shall be not less than 3/8-inch diameter.

G. Conduit hangers shall be attached to structural steel by means of non-metallic beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

H. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

I. No broken run shall exceed 500 feet in length. This length shall be reduced by 75 feet for each 90 degree elbow.

J. Conduit terminating in boxes shall have sealing double lock-nuts and insulating bushings.

K. Conduit terminating in gasketed enclosures shall be terminated with sealing conduit hubs.

L. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.

M. Liquidtight flexible metal conduit shall be used for all motor terminations and other outdoor equipment where vibration is present.

N. Flexible couplings shall be used in hazardous locations for all motor termination and other equipment where vibration is present.

O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete building structure; in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit runs above ground which is more than one hundred feet long and interval between expansion fittings in such a run shall not be greater than 100 feet.

P. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand-held dryers are prohibited.

Q. Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.

R. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless if shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with the Engineer prior to installation. This includes empty raceways for future use.

S. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls, etc., as required by NEC Article 300, whether shown on drawings or not.

T. Paint all field cut threads and coat all aluminum conduits in contact with concrete per manufacturer’s recommendations.

U. Raceways which do not have conductors furnished under this division of specification shall be left with an approved nylon pullcord in the raceway.

V. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings.

W. All aluminum conduits in contact with concrete shall be coated with bitumastic paint.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as hereinafter specified.

B. General Design

1. Wire for lighting, and receptacle circuits in the administration building shall be type THHN solid.
2. Wire for all power feeder and motor circuits outside of the administration building shall be type THHN stranded.
3. Single conductor wire for control, indication and metering shall be type THHN No. 14 AWG, stranded.
4. Multi-conductor control cable shall be No. 14 AWG, stranded tinned copper.
5. Wire for process instrumentation shall be No. 16 AWG, stranded tinned copper.
6. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

1.02 QUALITY ASSURANCE

A. Standards

1. Insulated Cable Engineers Association (ICEA)
2. Underwriters Laboratories, Inc. (UL)
3. American Society for Testing and Materials (ASTM)

B. Manufacturers

1. 600-volt wire and cable:

a. Hi-Tech Cable Corp.
b. Collyer Insulated Wire Co.
c. Okonite Co.
d. Rome Cable Co.
e. American Insulated Wire Corp.
f. Triangle PWC, Inc.. Or equal

2. Instrumentation and control cable:

a. American Insulated Wire Corp.
b. Rome Cable Corp.
c. Okonite Co.
d. Eaton Corp. "Polyset".
e. Triangle PWC, Inc.
f. Or Equal.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All conductors shall be carefully handled to avoid kinks or damage to the insulation.

B. All conductors stored outdoors shall be covered.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper conductors.

B. All conductors shall be stranded except lighting and receptacle circuits.

2.02 MATERIALS

A. 600-Volt Wire and Cable

1. Type THHN shall be PVC insulation with nylon jacket.

B. Instrumentation and Control Cable

1. Process instrumentation wire shall be twisted pair, 600-volt, cross linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP". Multi-conductor cables with individually shielded twisted pairs shall be installed where indicated.
2. Multi-conductor control cable shall be stranded, 600-volt, cross-linked polyethylene insulated with PVC jacket, type "XLP".

C. Terminations and Splices

1. Unless otherwise indicated on the plans, no splices may be made in the cables without prior approval of the Engineer. Where splicing is approved,

the splicing material shall be as recommended and approved by the cable manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be UL listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only as directed by the supplier of the instrument.

F. Wire and cable connections to terminals, splices, and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall not be less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or as approved by the Engineer.

H. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

I. Steel fish tapes and/or steel pulling cables shall not be used in PVC raceway systems.

J. Remove debris and moisture from the conduits, boxes, and cabinets prior to cable installation and mandrel with device of one size smaller than conduit and mandrel with wire brush one size larger than conduit.

3.02 TESTS

A. All 600-volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 1,000-VDC. A cable test data form shall be provided for Engineer review.

B. All service conductors shall be tested as in Paragraph A above. These tests shall be witnessed by the Engineer.

END OF SECTION

SECTION 16130
BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all junction boxes, pull boxes, service entrance boxes and for a complete raceway system as shown on the Drawings and as specified herein.

B. General Design

1. Unless otherwise hereinafter specified or shown on the Drawings, all boxes and fasteners shall be type NEMA 4X, 316-stainless steel.
2. All boxes in air conditioning plenums above ceilings shall be pressed steel.
3. All boxes that do not receive devices are to have blank plates installed matching wiring device plates.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (UL)
2. Federal Specifications (FS)
3. American Society for Testing and Material, (ASTM)

B. Manufacturers

1. Hoffman, Type CHNFSS.
2. Or Equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical—General Provisions.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Boxes and fittings shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All boxes and fittings shall be warranted against defects or failure for a period of one year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Boxes shall be constructed as follows:

1. 14-gauge 316L stainless steel.
2. Continuously welded and ground smooth, no holes or knockouts.
3. Seamless foam in-place gasket, watertight, dust-tight.
4. Stainless steel screws and clamps.

PART 3 EXECUTION

3.01 INSTALLATION

A. All boxes shall be supported away from surfaces.

B. All boxes shall be sized per the National Electrical Code (NEC).

C. All conduit entries into boxes shall not lower or change the NEMA rating of the box.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install wiring devices and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

2. Wiring devices shall include the following:

a. Wall Switches.
b. Device Plates.
c. Plugs.
d. Receptacles.
e. Lighting Control Time Clocks.
f. Lighting Contactors.
g. Control Stations.
h. Ground Fault Interrupter Receptacles.

B. Related Work Described Elsewhere

1. Electrical—General Provisions: Section 16050.
2. Raceways and Fittings: Section 16110.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories Inc. (UL).
2. National Electric Manufacturers Association (NEMA).
3. National Electrical Code (NEC).
4. Federal Specification (FS).

B. Manufacturers

1. Wall switches, device plates, plugs, and receptacles as follows:

a. Arrow-Hart.
b. Bryant.
c. Hubbell.

d. Leviton.
e. or Equal.

2. Clocks:

a. Simplex.
b. or Equal.

3. Lighting Contactors:

a. Square-D.
b. Cutler-Hammer.
c. or Equal.

4. Dimmer Controls:

a. Leviton.
b. Prescolite.
c. or Equal.

5. Control Stations:

a. Hoffman Engineering Co.
b. Square-D.
c. Crouse-Hinds.
d. Or Equal.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Submit material list and catalog cut-sheets for all items covered under this Section. Indicate type, ratings, material, color, and manufacturer.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All devices covered under this Section shall be stored indoors, protected from damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Switches

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to FS W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or equal. Any reference to a specific figure number of a specific manufacturer is for establishing a type and quality of product and shall not be considered as proprietary.

a. Single-pole – Arrow-Hart, Catalog No. 1991.
b. Double-pole – Arrow-Hart, Catalog No. 1992.
c. Three-way – Arrow-Hart, Catalog No. 1993.
d. Four-way – Arrow-Hart, Catalog No. 1994.
e. Single-pole, key-operated – Arrow-Hart Catalog No.1l991-L.
f. Momentary contact, two-circuit, center off – Arrow-Hart, Catalog No. 1895.
g. Weatherproof cover for Arrow-Hart 2900 series tap action switches – Arrow-Hart Catalog No. 2881-G.

B. Receptacles

1. Wall receptacles shall be of the following types and manufacturer or equal.

a. Single, 20A, 125V, 1P, 3W; Arrow-Hart, Catalog No 5351.
b. Duplex, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5352.
c. Weatherproof, 20A, 125V, 2P, 3W; Arrow-Hart, Catalog No. 5351 and WLRD-1 cover.
d. Corrosion-resistant, duplex, 20A, 1 25V, 2P, 3W; Arrow-Hart, Catalog No. 5351 and WLRD-l cover.
e. 60A, 480V, 3P, 2W; weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
f. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W; Arrow-Hart Catalog No. GF5342.
g. Stainless steel indoor mounting plate for G.F.I. receptacle; Arrow-Hart Catalog No. 97061.
h. Weatherproof cover for G.F.I. receptacle in FS box; Arrow-Hart Catalog No. 4501-FS.
i. Clock hanger, 15A, 125V, 2P, 3W; Arrow-Hart Catalog No. 452.

j. Single, 20A, 125V, 2P, 3W; Arrow-Hart Catalog No. 8510BL; cover: Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
k. Single, 30A, 125V, 2P, 3W; Arrow-Hart Catalog No. 5716N; cover: Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
l. Clothes dryer, 30A, 125/250V, 3P, 3W; Arrow-Hart Catalog No. 9344N. Matching cord set shall also be included.

C. Device Plates

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

D. Lighting Contactor

1. Lighting contactors shall be of the electrically operated, electrically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.
2. Contactors shall be rated for 25A 600-volt contacts and be similar and equal to Automatic Switch Company bulletin 1255-166 RC.

E. Lighting Control Time Switches

1. Time switches for the control of lighting shall have astronomic dials, reserve power and be similar and equal to the following types:

a. Where time switch is indicated to be for momentary contact operation it shall be similar and equal to Intermatic Inc. Catalog No. ET-70115-C.
b. Where time switch is indicated for SPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
c. Where time switch is indicated for DPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
d. Where time switch is indicated for roadway or equipment, lighting shall be similar or equal to Intermatic Inc. Catalog No. ET-7000 Series.

F. Control Stations

1. Control stations for start/stop pushbutton and hand-off-automatic selector switches shall be corrosion resistant, dust-tight, watertight and

weatherproof, NEMA 4X, 600 VAC, UL Standard 508 as manufactured by Crouse-Hinds Series NCS or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

B. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

C. Use bolt, screws, nuts and other threaded devices having standard threads and heads so they may be installed and replaced without special tools.

D. Check light switch locations before rough-in to avoid installing a switch behind the door swing.

E. The Engineer and Owner reserve the right to change any switch or receptacle location within the same room, without added cost prior to rough-in.

F. Locate outlets intended for the supply of specific items such as water coolers, copying machines, fans, etc., as recommended by the item manufacturer.

END OF SECTION

SECTION 16150
MOTORS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

B. Related Work Described Elsewhere:

1. Equipment: Division 11.

1.02 QUALIFICATIONS

A. Qualifications:

1. Motors shall be sufficient in size for the duty to be performed and shall not exceed their full-rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.
2. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

1.03 SUBMITTALS

A. The motor manufacturer shall submit to the Engineer: Shop Drawings, Working Drawings, and Samples: certified dimension prints showing nameplate data and outline dimensions.

B. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and proper installation for a period of one year from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the Contractor at no expense to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact

requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.

B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Rating:

1. Unless otherwise noted, motors 200 horsepower and below shall be of the low voltage type. Unless otherwise noted, all motors 1/2 through 200 horsepower shall be rated 230/460 volt, 3-phase, 60 Hertz AC, premium efficient, and motors: below 1/2 horsepower shall be rated 115/230-volt, 1-phase, 60/Hertz AC.
2. Motor connected to variable frequency drives shall be rated as inverter duty by the motor manufacturer. The motor manufacturer shall submit in writing that the motor is suitable for the drive.

B. All dripproof and weather protected Type 1 (WP1) motors shall have epoxy encapsulated windings. Small motors not readily available with encapsulated windings may be standard type, except non-encapsulated motors exposed to the outside atmosphere shall be totally enclosed.

C. All motors shall include space heaters to prevent condensation on the motor windings when the motor is not operating. The space heaters shall be sized by the motor manufacturer; maximum 200 watts; 120 volts.

D. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.

E. Low Voltage, Three-Phase Motors:

1. Motors shall be of the squirrel-cage or wound rotor induction type as noted. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as called for on the Drawings and as specified herein. All motors shall be built in accordance with current NEMA, IEEE, ANSI and AFMBA standards where applicable. Motors shall be of the type and quality described by the Specifications, and/or as

shown on the schedule on the Drawings, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.

2. Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.

3. Motors shall be of drip proof or weather protected Type 1 or totally enclosed fan cooled construction as called for on the Drawings or specified in other sections of these Specifications, with 1.15 service factor.

4. Motors shall be suitable for operation in moist air with hydrogen sulfide gas present.

5. The output shaft shall be suitable for direct connection or belt drive as required.

6. Motors shall have a Class F non-hygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.

7. All motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.

8. All fittings, bolts, nuts, screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads.

9. All machine surfaces shall be coated with rust inhibitor for each disassembly.

10. Motor terminal boxes shall be cast iron diagonally split, one size larger than the manufacturer's standard (motors above 200 HP only), pipe tapped for conduit and shall be attached to the motor frame with cadmium plated hex head cap screws. The box shall be arranged for rotation so that conduit entry from either sides, or bottom is possible. Gaskets shall be supplied between the box and the motor frame and between halves of the box. Cover shall be installed with cadmium plated hex head cap screws. The box shall come completely assembled to the motor. Motor leads in the conduit box shall have the same insulation class as the windings, shall be sized in accordance with EASA suggested minimum ampacity values using 105 degree C insulated lead wire. The wiring shall be clearly identified every inch or the lead shall have a metal band in accordance with ANSI C6.1, latest revision. Nameplates shall be supplied stating the

above data and permanently attached to the motor. Where the leads exit the motor frame, they shall pass through a tight fitting neoprene rubber seal to prevent foreign material or air passage and to hold the leads in a centered position. Motors shall be provided with a compression type grounding lug, mounted in the conduit box by drilling and tapping into the motor frame or by a double ended cap screw of silicon bronze.

11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.

12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

13. Low voltage, three-phase motors shall be manufactured by, Baldor, Marathon or Relience Electric.

14. Fractional Horsepower:

    a. Fractional horsepower motors shall be rigid, welded-steel designed to maintain accurate alignment of motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.
    b. Motor shaft shall be made from high-grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.
    c. For light to moderate loading bearings shall be quiet all angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.
    d. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, long-life grease, and large reservoir providing 10 years' normal operation without lubrication.

15. Integral Horsepower:

    a. Motor frames and end shield shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.
    b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.

c. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

d. Rotors shall be made from high-grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel-cage windings shall be cast-aluminum or bar-type construction with brazed end rings.

e. Motors shall be equipped with vacuum-degassed anti-friction bearings made to AFBMA Standards, and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.

f. Bearings of high thrust motors will be locked for momentary up thrust or 30 percent down thrust. All bearings shall have a minimum B10 life rating of 5 years in accordance with AFBMA life and thrust values.

g. Vertical hollow-shaft motors will have non-reverse ratchets to prevent backspin.

F. Inverter Duty Motors:

1. In addition to the requirements of 16150-2.02 A. B. C. D. and E., motors intended for use with variable frequency drives shall be inverter duty motors specifically designed for inverter operation, and shall be applied in accordance with NEMA, ANSI, IEEE, AFBMA AND NEC for the duty imposed by the driven and drive equipment. Inverter duty motors shall be specifically certified by the motor manufacturer to be compatible with the variable frequency drive to be used with the motor. Inverter duty motors shall be designed to operate over a frequency range of 0 to 66 Hertz. Motor insulation for all motors operating with variable frequency drives shall be Class H with Class F temperature rise when operated with the inverter continuously at all speed and load conditions throughout the specified operating range. Insulation systems shall be capable of withstanding a change in voltage (dV/dT) of 1600 peak volts and rise time greater than 0.1 microseconds without damage per NEMA MG-1 Section IV, Part 31.40.4.2. Motors rated less than 200 horsepower shall be protected with two normally closed thermal protectors in the stator winding and shall be set to open when the temperature reaches 155 degrees C. Motors rated 200 horsepower and greater shall have platinum RTD overtemperature protection. The motor frame shall be cast

iron. Inverter Duty motors shall be Baldor Inverter Drive Motors, Reliance Electric.

2. Motors shall be suitable for operation in moist air with hydrogen sulfide gas present
3. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.
4. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
5. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.

G. Low Voltage, Single Phase Motors:

1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open, drip proof, or totally enclosed fan cooled as called for on the Drawings or other sections of these Specifications, with temperature rise in accordance with NEMA Standards for Class B insulation.
2. Totally enclosed fan cooled motors shall be designed for severe duty.
3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have a corrosion protecting plating.
4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Motor connections: All motors shall be connected to the conduit system by a means of a short section (18 inch maximum) of flexible conduit unless otherwise indicated. For motor connections of No. 6 AWG and smaller wire size, the Contractor shall furnish flexible conduit with an approved grounding conductor inside the flexible section. For motor connections of No. 4 AWG or larger wire size, the Contractor shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.

3.02 INSPECTION AND TESTING

A. The following tests shall be performed on all motors after installation but before putting motors into service.

1. The Contractor shall megger each 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. The following table gives minimum acceptance insulation resistance in megohms at various temperatures and for various voltages with readings being taken after 1 minute of megger test run.

Winding Temp (F°)	115V.	230V.	460V.
37	60	108	210
50	32	60	120
68	13	26	50
86	5.6	11	21
104	2.4	4.5	8.8
122	1	2	3.7
140	.50	.85	1.6

2. The Contractor shall check all motors for correct clearances and alignment and for current lubrication, and shall lubricate if required in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

END OF SECTION

SECTION 16160
PANELBOARDS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Standards

1. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. *Standard for Panelboards* and *Standard for Cabinets and Boxes* and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

B. Manufacturer (NEMA 1 and NEMA4X)

1. 120/240V, single-phase, three-wire, and 120/208V three-phase, four-wire panelboards shall be as manufactured by the General Electric, Square D Co., or Cutler/Hammer.
2. 480V, three-phase, three-wire panelboards shall be as manufactured by Square D Co., I-Line, or Cutler/Hammer or General Electric.

C. Manufacturer (NEMA 3 and 12)

1. NEMA 3 and 12 panelboards shall be type NLP as manufactured by the Crouse-Hinds Company or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical—General Provisions.

PART 2 PRODUCTS

2.01 RATING

A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2.02 CONSTRUCTION AREA (NEMA 1)

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.
2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.
3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.
4. A nameplate shall be provided listing panel type, number of circuit breakers, ratings and source.

B. Buses

1. Bus bars for the mains shall be of tin-plated copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole circuit devices shall be arranged for sequence phasing of the branch circuit devises. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.
2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.
3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

C. Boxes

1. Recessed boxes shall be made from galvanized code gauge steel without multiple knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in Paragraph D4.
3. At least four interior mounting studs shall be provided.
4. All conduit entrances shall be field punched.

D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.
2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48 inches in height shall have a vault handle and three-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.
3. The trims shall be fabricated from code gauge sheet steel.
4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.
5. Trims for flush panels shall overlap the box by at least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

2.03 CONSTRUCTION (NEMA 4X)

A. Interiors and Buses

1. Interiors and buses shall be as hereinbefore specified for NEMA 1 construction.
2. Interior trim shall be complete. No exposed wiring allowed.

B. Boxes and Covers

1. Boxes and covers shall be made from 316 stainless steel.
2. Boxes and covers shall be hinged together and gasketed. All metallic parts on exterior shall be stainless steel.
3. Conduit openings shall be sealed with lock rings or sealing washers.
4. Polycarbonate or plastic enclosures or boxes are unacceptable.

2.04 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type, for NEMA 1 and plug-in for NEMA 4X.

C. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 amperes, RMS symmetrical.

D. Three pole breakers used in 480V panelboards shall have an interrupting capacity of not less than 25,000 amperes, RMS symmetrical.

E. GFCI

1. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be one-pole, 120-volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and in interrupting capacity of 10,000 amperes RMS.

PART 3 EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.

B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6 feet 0 inch above the floor, properly aligned and adequately supported independently of the connecting raceways.

C. All wiring in panelboards shall be neatly formed, grouped, laced and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the card holder inside the front cover.

END OF SECTION

SECTION 16170
SAFETY SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all motor and circuit disconnects as hereinafter specified and as shown on the drawing.

B. General Design

1. All switches shall be heavy duty and have stainless steel NEMA 4X enclosures and be horsepower rated.
2. All switches shall have metal nameplates, front cover mounted, that contain a permanent load, switch-type, catalog number and HP ratings, handle whose position is easily recognizable and is padlockable in the "off" position, visible blades, reinforced fuse clips, nonteasible, positive, quick make-quick break mechanism, switch assembly plus operating handle as an integral part of the enclosure base.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. All switches shall have line terminal shields.
4. All current carrying parts shall be copper.
5. Auxiliary contacts rated 10 ampere at 240 volts shall be provided, for motor space heater interlock and position indication.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electrical Manufacturer's Association (NEMA).
2. Underwriter's Laboratories (UL).
3. Federal Specifications (FS).
4. National Electrical Code (NEC).

B. Manufacturer

1. Switches shall be as manufactured by Square D Co. Class 9422, Cutler-Hammer, or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical—General Provisions.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All switches shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All switches shall be warranted against defect, rusting or failure for a period of 1 year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Where a six-pole weatherproof disconnect are called for on the drawings; the Contractor shall provide two 600-Volt, three-pole non-fusible switch in a single NEMA 4X stainless steel enclosure with a single operating handle mechanically interlocked to both disconnects.

B. All parts exposed to the weather or in hose down areas shall be stainless steel.

C. Short circuit rating - 10,000 RMS symmetrical amperes for non-fused switches.

D. Line and load lugs shall be front removable and suitable for copper, 60/75 degree C wire through 200A sizes, 75 degree C wire for 400-800A sizes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All switches shall be mounted as shown on the drawings.

B. Location of disconnect switches shall be per the NEC and shall be verified with the Engineer before installation.

C. All mounting appurtenances shall be 316 stainless steel including fasteners.

END OF SECTION

SECTION 16216
DIESEL ENGINE DRIVEN GENERATOR

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required and install, put into operation, and field test the diesel engine driven generator units and appurtenances as shown on the Drawings and specified herein.
2. These performance 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 as offered. It is, however, intended to cover the furnishing, the shop testing, and delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete units as herein specified, whether specifically mentioned in these Specifications or not.
3. For all units there shall be furnished and installed all necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in these Specifications or not. This installation shall incorporate the highest standards for the type of service including field testing of the entire installation and instruction of the regular operating personnel in the care, operation and maintenance of all equipment.
4. The generator unit shall be mounted as shown on the Drawings and shall be arranged for automatic starting and stopping, and load transfer upon failure of the normal source of power.

1.02 QUALITY ASSURANCE

A. Standards

1. The engine-generator set shall be the standard product, as modified by these Specifications, of a manufacturer regularly engaged in the production of this type of equipment. The unit to be furnished shall be of proven ability and shall be designed, constructed, and installed in accordance with best practices and methods. To qualify as a manufacturer, the engine must be the principal item manufactured and that manufacturer's authorized dealer shall supply the completed engine generator set only. The dealer shall have a minimum of 10 years' experience in the field of power generation.

2. The unit must be of such physical dimensions as to make a good installation in the opinion of the Engineer, in the space provided as indicated on the Drawings.
3. The unit shall be assembled in the U.S. with over 50% of the components such as the engine, generator, auxiliary equipment, etc., manufactured in the U.S. by a manufacturer currently engaged in the production of such equipment.
4. The unit shall be shipped to the job site by an authorized engine dealer having a parts and service facility within a 50-mile radius of the job site. In addition, and in order not to penalize the Owner for unnecessary or prolonged periods of time for service or repairs to the emergency system, the bidding generator set supplier must have no less than 80% of all engine replacement parts locally available at all times. Certified proof of this requirement shall be furnished to the Engineer upon request.
5. All materials and parts comprising the units shall be new and unused, of current manufacture, and of the highest grade, free from all defects or imperfections. Workmanship shall conform to the best modern practices. Only new and current models will be considered. The units offered under these Specifications shall be the product of a firm regularly engaged in the production of engine-generator equipment and shall meet the requirements of the Specifications set forth herein. Major exceptions to Specifications will be considered sufficient cause for rejection of the machines.
6. The generator unit shall be as manufactured by Caterpillar, or Cummins/Onan.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit to the Engineer for approval in a six complete sets of installation drawings, schematics, and wiring diagrams which shall show details of installation and connections to the work of other sections, including foundation drawing showing location and size of foundation bolts for the spring type vibration isolators and brochures covering each item of equipment.

2. In the event that it is impossible to conform with certain details of the Specifications due to different manufacturing techniques, describe completely all nonconforming aspects.

3. The submittal data for each unit shall include, but not necessarily be limited to, the following:

   a. Installation drawings showing plan and elevations of the complete generator unit; foundation plan; exhaust silencer; starting battery; battery charger; fuel tanks; radiator; and all other items requiring space for installation.

   b. Engine Data:

      (1) Manufacturer.
      (2) Model.
      (3) Number of cylinders.
      (4) RPM.
      (5) Bore x stroke.
      (6) Piston speed, FPM.
      (7) Make and model and descriptive literature of electric governor (where required).
      (8) Fuel consumption rate curves at various loads.
      (9) Engine continuous pump drive duty rating (without fan) HP.
      (10) Gross engine horsepower to produce generator standby rating (including fan and all parasitic loads) HP.

   c. Generator Data:

      (1) Manufacturer.

      (2) Model.

      (3) Rated KVA.

      (4) Rated kw.

      (5) Voltage.

      (6) Temperature rise above 40 degree C ambient:

         (a) Stator by thermometer.
         (b) Field by resistance.
         (c) Class of insulation.

(7) Generator efficiency including excitation losses and at 80% power factor.

(a) Full load.
(b) 3/4 load.
(c) 1/2 load.

d. Generator unit Control Data:

(1) Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided.
(2) Legends for all devices on all diagrams.
(3) Sequence of operation explanations for all portions of all schematic wiring diagrams.

e. Generator Unit and Accessories:

(1) Weight of skid mounted unit.
(2) Overall length.
(3) Overall width.
(4) Overall height.
(5) Exhaust pipe size.
(6) CFM of air required for combustion and ventilation.
(7) Heat rejected to jacket water and lubricating oil.
(8) Btu/hr.

f. Optional System Service Contract:

(1) Equipment Supplier Company Name:
Address:
City/State:
Phone Number:

(2) Attach the number of copies required of System Service Contract to submittal.

g. Furnish the number of copies required of the manufacturers certified shop test record of the complete engine driven generator unit.

B. Operating Instructions

1. Six 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.
2. A factory representative of the generator unit manufacturer, who has complete knowledge of proper operation and maintenance, shall be provided for 1 day to instruct representatives of the Owner and the Engineer on proper operation and maintenance. 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 - EXECUTION. 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.

1.04 SPARE PARTS

A. The manufacturer shall furnish any special tools required for normal operation and maintenance of the equipment.

1.05 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 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 surface of all exposed openings (exhaust, etc.) 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. 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.

1.06 WARRANTY AND GUARANTEES

A. All equipment supplied under this Section shall be warranted for a period of 2 years by the contractor and the equipment manufacturers. Warranty period shall commence upon completion of the 4-hour test.

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 in the machine(s) and the unit(s) restored to service 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.

PART 2 PRODUCTS

2.01 RATINGS

A. The rating of the generator set shall not exceed the manufacturer's published standby rating. The gross engine horsepower required to produce the standby rating shall not exceed the manufacturer's published continuous duty rating by more than 150%. Continuous duty rating shall be as defined as ASTM B5514 or DIN6271 but in no cast shall it exceed the manufacturer's published continuous duty rating for the engine as used in continuous rated pump drive applications. The gross engine horsepower required for the generator set standby rating described above shall include all parasitic demands such as generator inefficiencies, fuel pumps, water pumps, and all accessories necessary to the unit's proper operation while operating at rated load and at a rotative speed not to exceed 1,800 rpm.

B. The diesel engine driven generator set shall be capable of producing the specified standby kw rating for continuous electrical service during interruption of the normal utility source and shall be certified to this effect by the manufacturer for the actual unit supplied.

2.02 ENGINE

A. The engine shall be full compression ignition, four cycle, single acting, solid injection engine, either vertical or "V" type. Speed shall not exceed 1,800 revolutions per minute at normal full load operation.

B. The engine shall be capable of satisfactory performance on No. 2 fuel oil (ASTM D396). Diesel engines requiring a premium fuel will not be considered.

C. The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. Periodic cleaning of exhaust ports shall not be required.

D. The engine shall be equipped with fuel filters, lube oil filters, intake air filters, lube oil cooler, fuel transfer pump, fuel priming pump, service meter, engine driven water pump, and unit mounted instruments. Unit mounted instruments shall include, water temperature gauge, and lubrication oil pressure gauge. The engine shall be provided with low oil pressure, high water temperature and overspeed safety shutdowns of the manual reset type.

E. Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by ordinary mechanics without special diesel experience. The engines shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps shall be positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

F. The fuel system shall be equipped with fuel filters have replaceable elements. Filter elements shall be easily removable from their housing for replacing without breaking any fuel line connections, or disturbing the fuel pump, or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that the fuel will have been thoroughly filtered before it reaches the pump. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. The engines shall be equipped with a built-in gear-type, engine-driven fuel transfer pump, capable of supplying fuel through the filters to the injection pump at constant pressure.

G. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter and a water separator in the fuel inlet line to the engine.

H. The engine shall be provided with removable or re-buildable cylinder liners of close-grained alloy iron, heat treated for proper hardness as required for maximum liner life. The cylinder block shall be a one-piece stress relieved gray iron casting.

I. The engine shall have a gear-type lubricating oil pump for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Effective lubricating oil filters shall be provided and so located and connected that all oil being circulated is continuously filtered and cleaned. Filters shall be accessible, easily removed and cleaned and shall be equipped with a spring-loaded bypass valve as an insurance against stopping of lubricating oil circulation in the event the filters become clogged. The engine shall have a suitable water-cooled lubricating oil cooler.

J. The engine shall be provided with one or more engine mounted dry type air cleaners of sufficient capacity to protect effectively the working parts of the engine from dust and grit.

K. The engine governor shall control engine speed and transient load response within commercial and ISO 8528 tolerances. It will be selected, installed, and tested by the generator set manufacturer. The governor shall be mechanical with hydraulic assist as required. It shall maintain 3% or less speed droop from no load to full rated load. Steady state speed regulation shall be ± 0.33%. The governor shall be equipped with a vernier control and positive locking to allow manual speed adjustment.

2.03 COOLING SYSTEMS

A. The engine shall be furnished with an engine mounted belt drive radiator-type cooling system having sufficient capacity for cooling the engine when the diesel generator set is delivering full rated load in an ambient temperature not to exceed 110 degrees F. The engine shall be provided with a thermostatic valve placed in the jacket water outlet, between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions.

B. Closed circuit jacket water systems shall be treated with rust inhibited furnished by the engine manufacturer.

C. One unit mounted immersion type water heaters incorporating a thermostatic switch shall be furnished to maintain engine jacket water to 70 degrees F. The heaters shall be 115-volt, single phase, 60 Hertz, 1.5 kw.

2.04 EXHAUST SYSTEMS

A. A suitable 304 stainless steel silencer for residential silencing shall be furnished and mounted above the enclosure as shown on the Drawings. Silencers shall be constructed with inlet and outlet, required number of appropriate mounting brackets and ½-inch N.P.T. drain connection. Silencers shall be Maxim

Model M-51, equal product by Burgess Manning, or approved equal. All exhaust equipment must be rated to withstand temperatures of approximately 1,000 degrees F. A flexible stainless-steel pipe connection shall be provided between the engine exhaust stack and exhaust piping. One silencer rain cap with counterweight shall be provided for the unit.

2.05 GENERATOR, EXCITER AND ACCESSORIES

A. Rating: The generator rating is estimated at minimum, 750 kW, 937.5 kVA 0.8 p.f., 1,800 RPM, three-phase, 60 Hertz, 277/480 volts, 12 leads, with a maximum temperature rise of 130 degrees C (both armature and field) by resistance at full rated load in ambient air of 40 degrees C. The generator shall conform to NEMA MG-1.

B. Performance: The instantaneous voltage dip shall not exceed 30% of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 6 seconds. Steady state modulation shall not exceed 1/2%.

C. Construction

1. The generator and exciter shall be drip-proof, with split sleeve, or ball race bearings. A shaft-mounted brushless exciter shall be a part of the assembly. The stator core shall be built up of high-grade silicon steel laminations precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.
2. The exciter shall be a fast response type, with a rotating three-phase full-wave bridge. The exciter shall have a low time constant and large capacity to minimize voltage transients under severe load changes.
3. Generator stator and exciter stator windings shall be a full Class H insulated system vacuum impregnated with epoxy resin which after curing shall have additional treatment of epoxy for resistance to an environment of moisture and salt air. Generator coils shall be layer wound, and precision made, with turn-to-turn and ground insulation of glass yarn and mica materials.
4. Generator rotor poles shall be built up of individually insulated silicon steel punchings. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Generator windings shall be braced for full

line to ground fault currents, with two generators operating in parallel and a solid grounded neutral system. Cross-current compensation shall be provided for future parallel operation.

D. Accessories and Attachments:

1. Terminal Box: The unit shall contain a terminal box and any extension necessary and shall be sized and provided with space for three CTs.
2. Space Heaters: Space heaters shall be installed on the generator frame to maintain temperature of the entire generator above the dew point while not in use. Power supply shall be 120 volts single phase. Heaters will be automatically disconnected when engine starts a magnetic starter for heaters shall be mounted on the unit. Furnishing and installation of control and starter to be by engine/generator supplier.

E. Generator Associated Controls:

1. Voltage Regulator:

a. The automatic voltage regulator shall maintain generator output voltage by controlling the current applied to the exciter field of the generator.

b. The regulator shall be a totally solid-state design which includes electronic voltage buildup and overcurrent protection. It shall incorporate volts per Hertz characteristics with the regulated voltage a linear function proportional to frequency over a 30 to 70 Hz range.

c. The regulator shall be suitable for mounting within or external to the generator assembly and have provision for remote voltage level control.

d. As installed, the voltage regulator shall meet the applicable sections of the following standards:

(1) International Electrotechnical Commission (IEC).
(2) Institute of Electrical and Electronic Engineers (IEEE).
(3) National Electrical Manufacturers Association (NEMA).

e. The automatic voltage regulator shall be manufactured by the manufacturer of the engine-generator set. The regulator shall sense

line-to-line three phases of generator output voltage and exhibit the following characteristics:

(1) Generator output voltage maintained within ±1% of rated value for any load variation between no load and full load.
(2) Generator output voltage drift no more than ±2% of rated value at constant temperature.
(3) Generator output voltage drift no more than ±1% of rated value over ambient temperature range of 40°C to 70° C.
(4) Telephone Influence Factor (TIF) of less than 50.
(5) Electronic Interference/Radio Frequency Interference (EMI/RFI) suppressed to commercial standards.

f. The regulator shall include the following features:

(1) Voltage level rheostat shall provide generator output voltage adjustment of 25% to +10% of nominal.
(2) Gain adjustment shall provide output voltage compensation for changes in load or frequency.
(3) At full throttle engine starting, output voltage shall not overshoot more than 5% of its rated value, with respect to the volts/Hz curve.
(4) Response time shall be less than twenty milliseconds.
(5) Protection shall be provided against loss of voltage sensing and long term overcurrent conditions. The overcurrent protection function shall automatically reset when the regulator is de-energized. The regulator shall not be damaged or result in unsafe operation when subjected to open or shorted input due to sensing loss, or a short to ground or adjacent conductor. Fast blow fuses shall be included in two of the sensing leads to fully protect the regulator.
(6) The regulator module shall be sealed in a waterproof and air-proof shock resistant plastic housing and shall withstand:

g. Temperatures between 20 to 70°C.

h. Vibration of 4.5 G's (peak) between frequencies of 18 to 2,000 Hz in three perpendicular planes, and mechanical shock of 20 G's in all three planes.

i. Salt spray as described by MIL-STD-810C, Method 509.1 and ASTM B117.

2.06 GENERATOR CONTROLS

A. General

1. The control panel shall be designed and built by the engine-generator manufacturer. It shall be mounted on the generator set and incorporate 100% solid state microprocessor-based control circuitry, sealed dust tight, watertight modular components with metal housings, and digital instrumentation. The panel shall be labeled with ISO symbols and comply with IEC 144, IP 22, and NEMA 12 for external environmental resistance, and IP 44 and NEMA 12 for resistance of the internal sealed modules.

2. The panel shall be labeled with ISO symbols and include the following equipment:

    a. Generator AC Output Metering Devices:

        (1) Back-lit LCD displays for volts, hertz, and amps in a single environmentally sealed module. Numeral height shall be 13 mm (0.5-inch) with not less than 0.5% accuracy throughout a temperature range of 40 to +70°C. Distorted generator output voltage waveform of a crest factor less than 5 shall not affect metering accuracy.

    b. Engine Monitoring Devices:

        (1) Back-lit LCD or analog to sequentially rotate display of operating hours, engine RPM, batter DC volts, oil pressure, and jacket water temperature. A momentary switch shall be provided to continuously display a selected operating parameter. The display shall annunciate fault shutdowns, cycle programming, and diagnostic codes for troubleshooting. Engine monitoring signals provided by engine mounted lubricating oil pressure and coolant temperature transducers shall be communicated over a serial data link through a Data Sending Unit (DSU) to the panel control module. The safety logic shall shut the engine down if the serial data link is lost.

    c. Controls:

        (1) Generator voltage level rheostat and ammeter/voltmeter phase selector switch shall be mounted on the panel door.

The engine start-stop switch shall be door mounted and include positions for off/reset, run/start, stop, and automatic mode. Start-stop logic shall have provisions for cycle cranking and cool down operation.

d. Shutdowns/Annunciation:

(1) The generator set shall shut down and red flashing LEDs shall signal operational faults of high-water temperature, low oil pressure, overcrank, and overspeed.

e. Safety Devices:

(1) ISO red emergency stop pushbutton shall be provided, and all controls, annunciation, and monitors labeled with ISO symbols.

B. Circuit Breaker-Generator Set Mounted: The circuit breaker shall be mounted and connected in a guarded drip-proof enclosure meeting NEMA 1, IP 22, UL and IEC 144 requirement. Cable lugs shall be provided for customer connections. One molded case air circuit breaker, three-pole, single-throw, stationary-mounted with manual operating handle, overload and short circuit trips, complete with cable lugs. Overcurrent trip shall be sized to provide enclosed and ambient temperature compensation. The breaker and enclosure shall be qualified for 600-volt operation and tested in accordance with UL Standards.

2.07 BATTERIES, CHARGERS AND CONSOLES

A. Engine Cranking Batteries

1. The batteries shall be of the lead acid type and shall be of domestic manufacture. The batteries shall be designed for engine cranking service and shall be capable of cranking a diesel engine, of the size supplied for three 20-second cranking periods without being recharged. The batteries shall be mounted in suitable freestanding covered racks. Battery rack location will be as shown on the Shop Drawings. The electrical contractor shall provide the required lengths of all interconnecting battery cables. Minimum wire size and type shall be 2/0-welding cable. The battery set shall be sized for 40 degrees F ambient starting duty.
2. There shall be furnished transistor control mag amp design or solid state integrally mounted battery chargers with float equalize ability, an equalizing timer, and a low DC voltage alarm relay, and on/off circuit breaker type switches. Chargers shall be suitable for and sized for use with lead acid type batteries. Input shall be 115 volt AC, single phase.

Ammeters, voltmeters and other control devices, switches, control batteries, etc., shall be door mounted for good reference.

2.08 GENERATOR SET ENCLOSURE

A. One aluminum weatherproof, walk-in style enclosure shall be provided to weatherproof a generator set complete in every detail and require no additional in field modification or assembly. The enclosure is to be accurately dimensioned so as to be in compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) for clearance of all applicable fire codes for a structure and application of this type as assembled by Phoenix Products.

B. Construction

1. The enclosure shall consist of a roof, two sidewalls and two end walls of pre-painted, aluminum, stressed skin, semi-monocoque construction. The roof shall be a one piece cambered sheet of .125 inch thick aluminum with 3/16 inch thick extruded aluminum recessed side and end rails with cast aluminum recessed side and end rails with cast aluminum corners. The entire assembly shall be suitable to withstand 140 MPH winds with a 1.3 gust factor.
2. Enclosure dimensions shall be constructed for walking clearances for maintenance and operating personnel.
3. All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow good access to and visibility of instruments, controls, engine gauges, etc. The doorframes shall be aluminum consisting of forged aluminum bolted to the side panels. Forged aluminum hinges with stainless steel pins and nylon bushings shall also be provided. Personnel doors shall be manufactured from aluminum and be fully gasketed to form a weather-tight perimeter seal. A three-point latching assembly with interior latch release and exterior padlocking provisions shall also be provided on these doors.
4. Intake hood shall have sufficient free area to allow for 120% of the total engine/generator cooling air requirements used in this application. Intake hood shall be of all aluminum construction and shall be provided with bird screens. The radiator end of the enclosure shall be fitted air deflector plates, stainless steel exhaust deflectors and discharge plenum.
5. The manufacturer of the enclosure shall provide mounting brackets for the exhaust silencer(s) specified. In addition, a tail pipe extension(s) and rain cap to prevent the entrance of rainwater shall also be provided. Further, a stainless steel, seamless bellows, flexible exhaust tube(s) and all necessary bolts, flanges, and gaskets to mate with the engine and exhaust silencer(s) shall be provided.

6. Upon final assembly of the enclosure, it shall be prime painted with a minimum of two coats of aluminum primer. The final finish painting shall be a minimum of two coats of paint (color to be specified by the Owner).
7. All wiring within the enclosure shall be installed in EMT raceways. All connections to the generator set shall be flexible.
8. A battery operated light deriving its power from the engine cranking batteries shall be installed in a strategic location within the enclosure and shall be controlled by a switch located by one of the entrance doors. The lights shall be large enough to provide illumination in an emergency situation, yet not such that an overburdening drain will be placed on the starting batteries. The switch controlling this light shall be a wind-up timer type which automatically shuts off after a preset interval not to exceed 1 hour.
9. Six 48-inch dual-tube LED enclosed vaportight lights shall be installed within the enclosure and strategically located on either side of the generator set. They shall be ceiling mounted and parallel to the length of the unit. Their AC power source shall be taken from the commercial power supply at the job site and wired-in by way of the 120/208-volt, three-phase, four-wire load center located within the enclosure. The light switch box, located by one of the entrance doors, shall have its own-grounded duplex receptacle mounted therein for use by maintenance personnel.
10. The enclosure shall be equipped with a 10 kVA 480-120-208 volt, three-phase, four-wire load center as a single entry point for commercial power supply conduits and wiring by the installing contractor for the battery charger, jacket water heater(s), lighting, receptacles, etc., as specified and as shown on the drawings. The load center shall be mounted within the enclosure and allow for site condition conduit entry from below. The load center shall include surge protector rated a minimum of 50 kA per mode, NEMA 4X. The placement of this load center shall be shown on the submittal drawings. All internal wiring and conduit runs to the various ancillary equipment supplied with the package shall be pre-wired at the factory in accordance with all governing codes pursuant to this application. The load center shall be considered as part of the emergency load and shall derive its power source downstream from the load transfer switch specified elsewhere.
11. The enclosure shall include two aluminum entry stairs for constructed in accordance with OSHA and local building codes.

2.09 FUEL SYSTEM

A. Fuel Piping and Fittings

1. Black iron pipe and fittings shall be used for all fuel piping. The fittings shall be black pattern malleable iron threaded and shall conform to ANSI B-16.3 standard weight and NFPA-30 and 37.
2. All pipe in contact with the soil shall have a secondary containment system as manufactured by R&G Sloan Co. or equal.

2.10 5000 GALLON DIESEL FUEL STORAGE

A. Diesel fuel storage for the generator set shall be provided by a base mounted dual-wall fuel secondary containment tank integral with the generator set and tested at 3 psi. All fuel piping shall be internal to the unit.

1. Primary tank constructed of 10-gage steel top.
2. Primary tank constructed 12-gage steel bottom, sides, end and baffles.
3. Outer tank constructed of 7-gage steel channels, 10-gage steel bottom, ends.
4. 2-inch NPT fill connection.
5. 1-1/4-inch NPT normal inner tank vent.
6. 1-1/4-inch NPT normal outer tank vent.
7. 1-inch fuel return.
8. Removable fuel supply dip tube.
9. Level switch connections.
10. Exterior drain.
11. Interior epoxy coated.
12. Exterior enamel gloss black.
13. Neoprene base pad.

B. The volume of the base mounted tank shall be a nominal 5,000 gallons with maximum height of 24 inches and shall be the standard product as manufactured and supplied by the generator manufacturer.

C. The tank shall include an automatic continuous leak detection monitoring system to detect fuel present between the primary tank and secondary containment with a leak detection alarm with dry contacts. The tank shall also include a fuel high-level alarm dry contact; fuel gauge (scaled at 0–5,000 gallons); low level alarm dry contacts; 1/2-inch stainless steel drain valve and fuel fill limiter.

PART 3 EXECUTION

3.01 INSTALLATION

A. 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 period of not less than 1 day to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The visit will be for checking and inspecting the equipment after it is installed and shall be allocated solely to the instruction of plat 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 six copies of operation and maintenance manuals must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

B. The Contractor shall install suitable jacket water additives, including antifreeze, as furnished by the engine manufacturer and approved by the Engineer, for prevention of both scale formation and corrosion in the water jackets and cooling system components which are in contact with the engine jacket water. These additives shall be added to the cooling system prior to running the field acceptable test.

C. The Contractor shall install the complete exhaust system, together with the silencer, the piping and insulation, and the complete supporting system. Where the exhaust passes through the roof there shall be furnished and installed suitable "rain skirt."

3.02 PAINTING

A. The engine generator set and associated equipment shall be shop primed and finish coated in accordance with the manufacturer's standard practice prior to shipment.

3.03 INSPECTION AND TESTING

A. Prior to acceptance of the generator set all equipment furnished hereunder shall be tested to show it is free of any defects and the generator set can operate satisfactorily under full load test using resistance type load banks for 4 hours (brine tanks not acceptable). Any defects that become evident at this time shall be corrected before acceptance.

B. Owner will not provide fuel for testing.

END OF SECTION

SECTION 16250
AUTOMATIC TRANSFER SWITCH

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish and install one automatic transfer switch including all appurtenances required as shown on the Drawing and specified herein.

1.02 QUALITY ASSURANCE

A. Standards:

1. Underwriters' Laboratories (UL) 1008.
2. National Electric Code (NEC).
3. National Electrical Manufacturers' Association (NEMA).

B. Manufacturers:

1. ASCO.
2. Eaton.
3. GE Zenith.

1.03 SUBMITTALS

A. Submit shop drawings and product data clearly indicating:

1. Cabinet dimensions.
2. All applicable options and accessories.
3. Wiring diagrams.
4. Interrupting or withstanding current rating.
5. All electrical characteristics and data as required to show compliance with these specifications.

B. To establish conformance with the above, manufacturer must produce certified test reports from an independent testing laboratory to verify the identical samples have been subject to three-phase short circuit current at rated voltage, for a minimum of three cycles duration, without contact damage or contact welding and without the use of current limiting fuse protection. Oscillograph traces are to be supplied to verify that the test parameters have been met.

1.04 PRODUCT DELIVERY STORAGE AND HANDLING

A. The equipment shall be stored indoors in a dry location at all times.

B. The equipment shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angles.

C. The equipment shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by the ATS Manufacturer.

D. Each box or package shall be properly marked to show its net weight in addition to its contents.

PART 2 PRODUCTS

2.01 AUTOMATIC TRANSFER SWITCH

A. General:

1. Install as specified herein and on the Drawings, an automatic transfer switch to protect the load from loss of power. The load transfer control shall be fully rated 1,600 amp, 4-pole for continuous duty and for all classes of load. The control components shall be compatible with the electrical requirements of the standby set.

    a. Upon power line outage, automatically start the generating set and when the set comes up to speed and voltage, disconnect the load circuits from the power line and transfer them to the standby set's output.
    b. Upon power line return, transfer the load back to the line and stop the standby set.

2. On failure of normal power, or a drop in voltage on any phase to 70% of normal, contacts shall close after a delay of 2.5 seconds to override momentary voltage fluctuations and signal the engine generator to start. When the generator reaches a 90% of rated voltage and frequency, the switch shall operate to transfer the load to the generator. On restoration of all phases of normal power to 90% or more of nominal voltage for an adjustable period of up to 9,990 hours, the switch shall retransfer the load to normal and the engine starting contacts shall open.

3. The transfer switch shall be a mechanically held device utilizing two circuit breakers or contactors. Circuit breakers shall be high instantaneous trip circuit interrupters, trip free in the closed position, complete with

terminal lugs suitable for copper or aluminum conductors. The breakers shall be operated by a common transfer mechanism to provide double throw switching action.

4. The transfer mechanism shall be electrically operated by a single unidirectional gear motor which shall be powered by the source to which the switch is transferring. The switch shall be mechanically and electrically interlocked. The switch shall be capable of manual operation and shall have provision for disengaging the motor when so operated. It shall not be possible for the load to be simultaneously connected to the normal and emergency sources during manual operation to allow maintenance of load circuits. The speed of contact opening and closure shall be the same during manual and automatic operation.

5. The switch shall have equal withstand, closing and interrupting rating at the voltage employed, sufficient for the available short circuit at the point of application.

6. The control circuit shall utilize solid state components mounted on printed circuit boards wherever practical, to accomplish functions such as timing, voltage, and frequency monitoring. Circuit boards shall be individually replaceable plug-in type. Relays shall be plug-in dust-proof type. Voltage sensing relays shall be solid state, field adjustable, close differential type with positive locks which operate without affecting relay settings.

7. The entire transfer switch and accessories shall be enclosed in a NEMA 12 painted steel enclosure with hinged door. It shall contain a spare pair of contacts, one for normal and one for emergency, a solid neutral bar and four-position selector switch with test-auto-off and engine start positions. It shall be UL-1008 listed, including accessories, in accordance with NEC 700 and CSA approved. It shall include the following accessories:

    a. Time Delay Starting Engine: Adjustable from 0.6300 seconds with tin plated contacts.
    b. Time Delay Normal to Emergency: Adjustable from 0.1 to 9,990 hours. Factory set at 0.1 seconds.
    c. Time Delay Emergency to Normal: Adjustable from 0.1 to 9,990 hours. Factory set at 2 minutes.
    d. Time Delay for Engine Cool Off: Adjustable from 0.1 to 9,990 hours. Factory set at 5 minutes.
    e. Frequency and Voltage Relays for Normal Source and Emergency Source. Under Volt Adj. 90%; Pickup 70% Drop.
    f. Time Delay Motor Load Transfer: Adjustable from 0.5 to 10 seconds. In-phase monitors and motor disconnects are unacceptable.

g. Pilot Lights: Normal Supply Green in Cover; Emergency Supply Red in Cover.
h. Plant Exerciser: 7-day type with provisions to exercise with or without load with Selector Switch.
i. Engine Start Contacts.
j. Remote shunt trip relay to prevent generator starting, if required by local codes.
k. Auxiliary contacts for remote power failure relaying.

PART 3 EXECUTION

3.01 INSTALLATION

A. 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 period of not less than 1 day to inspect the installed equipment, supervise the initial test run, and to provide instructions to the plant personnel. The visit will be for checking and inspecting the equipment after it is installed and shall be allocated solely to 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 six copies of operation and maintenance manuals specified in Section 01830, Operations and Maintenance Manuals, must have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

3.02 INSPECTION AND TESTING

A. Prior to acceptance of the automatic transfer switch all equipment furnished hereunder shall be tested to show it is free of any defects and the generator set can operate satisfactorily under loaded conditions.

END OF SECTION

SECTION 16402
UNDERGROUND SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install a complete underground system of ducts, manholes and handholes all as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Excavation and backfilling is included in Division 2, Site Construction.
2. All concrete and reinforcing steel shall be included under Division 3, Concrete.
3. Conduit for ducts shall be as specified under Section 16110, Raceways and Fittings.
4. Ground rods and other grounding materials and methods shall be as specified under other sections of Division 16, Electrical.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ducts shall be encased in concrete as indicated on the plans.

B. Cable racks, supports, pulling-in irons, manhole steps, and hardware shall be galvanized steel manufactured by Cope or equal.

C. Precast manholes and handholes shall be heavy duty type, designed for a Class H20 wheel load. Precast manholes and handholes shall be as manufactured by Brooks Products Co.

D. Handhole covers and frames shall be as shown on the Drawings.

E. Fireproofing tape shall be Irvington No. 7700 or be an approved equal product.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ducts shall be installed to drain away from buildings; ducts between manholes or handholes shall drain toward the manholes or handholes. Duct slopes shall not be less than 3 inches per 100 feet.

B. Duct banks shall be reinforced as shown on the Drawings.

C. Duct lines shall be laid in trenches on a clean backfill bedding not less than 6 inches thick and well graded.

D. Plastic spacers shall be used to hold ducts in place. Spacers shall provide not less than 2-inch clearance between ducts.

E. The minimum cover for duct lines shall be 24 inches unless otherwise permitted by the Engineer.

F. Duct entrances to buildings and structures shall be made with steel conduit not less than 10 feet long.

G. PVC duct termination at manholes shall be with PVC end bells. Steel conduits shall be terminated with insulated, grounding-type bushings.

H. Where bends in ducts are required, long radius elbows, sweeps and offsets shall be used.

I. All ducts shall be rodded and a mandrel drawn through followed by a swab to clean out any obstructions which may cause cable abrasions. The mandrel shall be 12 inches in length and the diameter 1/2 inch less than the inside diameter of the duct.

J. Spare ducts shall be plugged and sealed watertight at all manholes, buildings and structures.

K. Ducts in use shall be sealed watertight at all manholes, buildings and structures.

L. Pulling-in irons shall be installed opposite all duct entrances to manholes, equal to Cope Catalog No. 311-9.

M. Cable racks shall be similar and equal to Cope Catalog 324-T, cut to length for one, two, three or four vertical tiers of cables. Racks shall be mounted with 1/2-inch by 4-inch expansion bolts on manhole walls. Arms similar and equal to Cope Catalog No. 325-T4, 325-T75 and/or 325-T10 for one, two and/or three cables, respectively, shall be furnished and installed with Catalog No. 326-T22

porcelain insulators for support of cables. Lock clips shall be furnished and installed to secure hooks in position.

N. Cables shall be trained in manholes and supported on racks and hooks at intervals not greater than 3 feet - 0 inches and supports shall be installed on each side of all splices. Furnish inserts on all manhole walls for mounting future racks as well as racks required for present installation. Branch circuit conductors shall not be run in manholes.

O. Fireproofing shall be furnished for all 5-KV cables in manholes. Each individual 5-KV cable shall be wrapped with an arc-proofing tape. The tape shall be applied in accordance with the manufacturer's recommendations. The wrapping shall extend into the end bells.

P. Aluminim rigid conduit shall be used for risers.

Q. All risers from underground shall be given a heavy coat of bitumastic paint from a point 1 foot–0 inches below grade to a point not less than 6 inches above grade or surface of slab.

R. All joints shall be made so as to prevent the passage of concrete inside the conduit to form obstructions or cause cable abrasions.

S. Manhole covers in streets shall finish flush with finished paving and in other areas shall finish 3 inches above crown of adjacent roadway. Floor elevations of manholes shall be so set that the center line of the lowest conduit entering will be not less than 1 foot above the floor and center line of the highest conduit entering will be not less than 1 foot below the roof slab.

T. Concrete monuments shall be provided at each stubbed conduit location. Monuments shall be as shown on the Drawings and shall be installed in the same manner outlined for manhole covers.

U. A #6 bare copper wire (stranded) shall be installed in each 4-inch PVC conduit.

V. A 5/8-inch by l0-foot copper clad ground rod shall be driven in the bottom of each manhole. All bond wires and galvanized steel conduits shall be bonded to the ground rod.

END OF SECTION

SECTION 16450
GROUNDING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Conduit: Section 16110, Raceways and Fittings.
2. Wire: Section 16120, Wires and Cables.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

a. Certified shop drawings with performance data and physical characteristics.
b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
c. All information required by Section 01330, Submittals and Acceptance.
d. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver a complete system ready to install as job progress requires.

PART 2 PRODUCTS

2.01 GENERAL

A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishings, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications, or shown on the Drawings shall be furnished and installed.

B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Ground rods: Ground rods shall be copper clad steel 3/4-inch-x-20-foot, minimum depth. Ground rods shall be copperweld or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The 480-volt switchgear ground bus shall be grounded to a ground loop system. The protecting conduits shall be bonded to the grounding conductor at both ends.

B. All steel building columns shall be bonded together and connected to the building ground grid.

C. Motors shall be grounded as hereinafter specified.

D. Lighting transformer neutrals shall be grounded to the nearest grounding electrode.

E. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

F. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.

G. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or equal. All buried connections shall be made by welding process such as Cadweld or equal.

H. For reasons of mechanical strength, grounding conductors shall be No. 10 AWG minimum copper, minimum size.

I. All underground conductors shall be laid slack and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

J. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 INSPECTION AND TESTING

A. The Contractor shall obtain the services of an NETA recognized testing firm to measure the ground resistance of the system. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment.

END OF SECTION

SECTION 16500
LIGHTING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install complete lighting systems including panelboards, transformers, lighting fixtures, receptacles, switches, contractors, clocks and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Conduit: Section 16110, Raceways and Fittings.
2. Wire: Section 16120, Wires and Cables.
3. Panelboards: Section 16160, Panelboards.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be a product of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.
2. The system shall be furnished by a single manufacturer who shall be responsible for the coordination of the system design and who shall assume complete responsibility for the proper operation of the system including equipment supplied but not of his manufacture.

B. Standards

1. All lighting fixtures shall be in accordance with the National Electrical Code and shall be constructed in accordance with the latest edition of the Underwriters Laboratories "Standards for Safety, Electrical Lighting Fixtures". All lighting fixtures shall be Underwriters Laboratories labeled.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Copies of all materials to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

a. Certified shop drawings with performance data and physical characteristics.
b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
c. A complete total bill of materials for all equipment.
d. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

2. If it is impossible to conform with certain details of the specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

PART 2 PRODUCTS

2.01 GENERAL

A. The specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field-testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these specifications or shown on the Drawings shall be furnished and installed.

B. The material covered by these specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Lighting Fixtures

1. Lighting fixture types shall be as shown on the "Lighting Fixture Schedule" on the Drawings. The catalog numbers listed are given as a

guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable.

B. Lamps

1. Fluorescent lamps shall be medium bi-pin and recessed double contact, rapid start, standard cool white, all as indicated on the "Fixture Schedule".
2. Fluorescent electronic ballasts shall be Class P, rapid start, high power factor, energy saving, CBM certified by E.T.L. and listed by Underwriters Laboratories, Inc., for operation on 120 volts or as indicated in the "Fixture Schedule".
3. High pressure sodium or metal halide ballast shall be of the constant wattage auto-transformer type of the correct size and voltage for the fixture it is to serve as called for in the "Lighting Fixture Schedule" on the Drawings. All ballast shall be as manufactured by Universal Manufacturing Corp., General Electric Company, Advance Transformer Company or equal.
4. Incandescent lamps shall be inside frosted, extended service, 2,500-hour life with medium base.
5. All lamps shall be of one manufacturer and shall be as manufactured by Sylvania Electric Products, Inc., General Electric Company, Westinghouse Electric Corporation or equal.

C. Flexible Fixture Hangers

1. Flexible fixture hangers used in nonhazardous areas shall be Type ARB and flexible fixture supports used in hazardous areas shall be Type ECHF as manufactured by the Crouse-Hinds Company or equal.
2. FRP channel shall be used to span for mounting of fixtures when required by fixture location or as indicated on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a complete finished unit with all components, mounting and/or hanging devices necessary, for the proper installation of the particular fixture in its designation location and shall be completely wired ready for connection to the branch circuit wires at the outlet.

B. When fixtures are noted to be installed flush, they shall be complete with the proper accessories for installing in the particular ceiling involved. All flush mounted fixtures shall be supported from the structure and shall not be dependent on the hung ceilings for their support.

C. Flexible fixture hangers shall be used for all pendant mounted fixtures.

D. Conduit run in areas with hung ceilings shall be installed in the space above the hung ceiling as close to the structure as possible. Conduit shall be supported from the structure.

3.02 REPLACEMENT

A. Lamps used during the building construction, prior to two weeks from completion of the work, shall be removed and replaced with new lamps.

3.03 CLEANING UP

A. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION

SECTION 16601
LIGHTNING PROTECTION SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required and install a complete lightning protection system for all the proposed above ground structures. The system shall include grounding of all handrail and platform structures as follows.

   a. BNR Structure
   b. Leachate Structure
   c. Electrical Buildings #1 and #2
   d. Generator Building
   e. Chemical Building
   f. Analyzer Building
   g. Office Building

2. Material requirements shall be as listed for Class I buildings.

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American National Standards Inst., Inc. (ANSI)

   a. ANSI C-135.30 Galvanized Ferrous Ground Rods.

2. National Fire Protection Association (NFPA)

   a. NFPA 70-1987 National Electrical Code (NEC).
   b. NFPA 78-1986 Lightning Protection Code.

3. Underwriters Laboratories, Inc. (UL)

   a. UL-96 Lightning Protection Components.
   b. UL-96A Installation Requirements for Lightning Protection Systems.
   c. UL-467 Grounding and Bonding Equipment.

1.02 QUALITY ASSURANCE

A. Equipment Manufacturer: The material furnished under this specification shall consist of the standard products of a manufacturer regularly engaged in the production of lightning protection systems.

B. Supervision: The system shall be installed under supervision of, or by, a person specifically trained for installation of lightning protection systems.

1.03 SUBMITTALS

A. Shop Drawings: Shop drawings shall be submitted in accordance with Section 01330, Submittals and Acceptance, and shall consist of a complete list of materials, including manufacturer's descriptive and technical literature; catalog cuts; drawings; and installation instructions. Shop drawings shall contain details to demonstrate that the system has been coordinated and will function as a unit. Drawings shall show proposed layout and mounting and relationship to other parts of the work.

B. Proof of Compliance: Where materials or equipment are specified to comply with requirements of the UL, proof of such compliance shall be submitted. The label of or listing in the UL Electrical Construction Materials Directory will be acceptable evidence. In lieu of the label or listing, a written certification may be submitted from an approved nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of Underwriters' Laboratories.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General Requirements:

1. The system furnished shall be complete with all air terminals, fittings, clamps, supports, roof conductors, down conductors, and horizontal grounds required. The system shall be interconnected with the building ground grid. All conductors, fittings, clamps, and air terminals furnished shall be of the highest quality.
2. System shall be an exposed conductor system. Care shall be taken that the materials used will not discolor roofs or walls. Down conductors shall be protected to 10 feet above grade and shall be located so that visual impact will be minimal.
3. No combination of materials shall be used that form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals.

Where unusual conditions exist which would cause corrosion of conductors, conductors with protective coatings or oversize conductors shall be used. Where a mechanical hazard is involved, the conductor size shall be increased to compensate for the hazard or the conductors shall be protected by covering them with molding or tubing made of wood or non-magnetic material.

B. Copper: Copper conductors shall not be less than #6 AWG for main conductor and #8 for secondary conductor. Below grade conductors shall be #4/0 bare copper.

C. Air Terminals: Air terminals shall be 3/8 inch diameter stainless steel and a minimum 24 inches in length. Air terminals over 24 inches shall be supported.

D. Ground Rods: Ground rods shall be 3/4 inch by 10 feet copper-clad steel, with the top of the rod, 12 inches below grade minimum and a minimum of 2 feet from building foundation and footings.

E. Clamp-Type Connectors: Clamp-type connectors shall be of copper, bronze, or stainless steel. Clamps shall be secured with at least two bolts or cap screws.

F. Metal Bodies: Metal bodies of conductance shall be bonded to the system if not within the zone of protection on an air terminal. Metal bodies of inductance shall be bonded to the system at their closest point to the system if within 6 feet of the system at their closest point to the system if within 6 feet of the system main conductor or other bonded metal body. The main lightning conductor shall be bonded to the main potable service water pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. General Requirements: The lightning protection system shall consist of air terminals, roof conductors, down conductors, ground connections, and grounds, electrically interconnected to form the shortest distance to ground without passing through any non-conducting parts of the structure. All conductors on the structures shall be exposed except where conductors are in protective sleeves exposed on the outside walls. Exposed down conductors shall not be allowed on the outside face of the High Service Building and Chemical Building. Exposed conductors shall be installed in a PVC-80 conduit on all other structures. Secondary conductors shall interconnect with grounded metallic parts within the building. Interconnections made within side-flash distances shall be at or above the level of the grounded metallic parts.

B. Air Terminals: Air terminal design and support shall be in accordance with NFPA 78. Terminals shall be rigidly connected to, and made electrically continuous with, roof conductors by means of pressure connectors or crimped joints with of T-shaped malleable metal and connected to the air terminal by a dowel or threaded fitting. Air terminals at the ends of the structure shall be set not more than 2 feet from the ends of the ridge or edges and corners of roofs. Spacing of air terminals 2 feet in height on ridges, parapets and around the perimeter of buildings with flat roofs shall not exceed 25 feet. In specific instances where it is necessary to exceed this spacing, the specified height of air terminals shall be increased not less than 2 inches for each foot of increase over 25 feet. On large, flat or gently sloping roofs, as defined in NFPA 78, air terminals shall be placed at points of the intersection of imaginary lines dividing the surface into rectangles having sides not exceeding 50 feet in length. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure. Metal projections and metal parts of buildings, smokestacks, and other metal objects that do not contain hazardous materials and that may be struck but not appreciably damaged by lightning, need not be provided with air terminals. However, these metal objects shall be bonded to the lightning conductor through a metal conductor of the same unit weight per length as the main conductor. Where metal ventilators are installed, air terminals shall be mounted thereon, where practicable. Any air terminal erected by necessity adjacent to a metal ventilator shall be bonded to the ventilator near the top and bottom thereof. Where nonmetallic spires, steeples, or ventilators are present, air terminals shall be mounted thereon or to the side. In addition, where spires or steeples project more than 10 feet above the building, the conductor between the air terminal and metal roof shall be continued to the nearest down conductor and securely connected thereto.

C. Roof Conductors: Roof conductors shall be connected directly to the roof or ridge roll. Sharp bends or turns in conductors shall be avoided. Necessary turns shall have a radius of not less than 8 inches. Conductors shall preserve a downward or horizontal course and shall be rigidly fastened every 4 feet along the roof and down the building to ground. Metal ventilators shall be rigidly connected to the roof conductor at three places. All connections shall be electrically continuous. Roof conductors shall be coursed along the contours of flat roofs, ridges, parapets, and edges; and where necessary, over flat surfaces, in such a way as to join each air terminal to all the rest. Roof conductors surrounding tank tops, decks, flat surfaces, and flat roofs shall be connected to form a closed loop.

D. Down Conductors: Down conductors shall be electrically continuous from air terminals and roof conductors to grounding electrodes. Down conductors shall be coursed over extreme outer portions of the building, such as corners, with consideration given to the location of ground connections and air terminals. Each building or structure shall have not less than two down conductors located as

widely separated as practicable, at diagonally opposite corners. On irregularly shaped structures, the total number of down conductors shall be sufficient to make the average distance between them along the perimeter not greater than 100 feet. Additional down conductors shall be installed when necessary to avoid "dead ends" or branch conductors exceeding 16 feet in length, ending at air terminals. Down conductors shall be equally and symmetrically spaced about the perimeter of the structure. All down conductors shall be protected and installed in a raceway, to prevent mechanical injury to the conductor.

E. Interconnection of Metallic Parts: Metal doors, windows, and gutters shall be connected directly to the grounds or down conductors using not smaller than No. 6 copper conductor, or equivalent. Conductors placed where there is probability of unusual wear, mechanical injury, or corrosion shall be of greater electrical capacity than would normally be used, or shall be protected. The ground connection to metal doors and windows shall be by means of mechanical ties under pressure, or equivalent.

F. Ground Connections: Ground connections Comprising continuations of down conductors form the structure to the grounding electrode shall securely connect the down conductor and ground in a manner to ensure electrical continuity between the two. All connections shall be of the clamp type. There shall be a ground connection for each down conductor. Metal water pipes and other large underground metallic objects shall be bonded together with all grounding mediums. Ground connections shall be protected from mechanical injury. In making ground connections, advantage shall be taken of all permanently moist places where practicable, although such places shall be avoided if the area is wet with waste water that contains chemical substances, especially those corrosive to metal.

G. Grounding Electrodes: A grounding electrode shall be provided for each down conductor located as shown. A driven ground shall extend into the earth for a distance of not less than 10 feet. Ground rods shall be set not less than 2 feet, nor more than 10 feet, from the structure. The complete installation shall have a total resistance to ground of not more than 10 ohms (if a counterpoise is not used). When two of any three ground rods, driven not less than 10 feet into the perimeter, give a combined value exceeding 50 ohms immediately after driving, a counterpoise shall be used. A counterpoise, where required, shall be of No. 1/0 copper cable or equivalent material having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 2 feet deep at a distance not less than 2 feet nor more than 10 feet from the nearest point of the structure. All connections between ground connectors and grounds or counterpoise, and between counterpoise and grounds shall be electrically continuous. Where so indicated on the drawings, an alternate method for grounding electrodes in shallow soil shall be provided by digging trenches

radially from the building. The lower ends of the down conductors (or their equivalent in the form of metal strips or wires) are then buried in the trenches.

H. Interconnection of Metal Bodies: Metal bodies of conductance shall be protected if not within the zone of protection of an air terminal. All metal bodies of conductance having an area of 400 square inches or greater or a volume of 1,000 cubic inches or greater shall be bonded to the lightning protection system using main size conductors and a bonding plate having a surface contact area of not less than 3 square inches. Provisions shall be made to guard against the corrosive effect of bonding dissimilar metals. Metal bodies of inductance shall be bonded at their closest point to the lighting protection system using secondary bonding conductors and fittings. A metal body that exceeds 5 feet in any dimension, that is situated wholly within a building, and that does not at any point come within 6 feet of a lightning conductor or metal connected thereto shall be independently grounded.

3.02 TESTING

A. System shall be installed so that tests of the grounds may be performed upon completion of the installation of the system and in the future.

B. As soon as practicable after award of contract, the Contractor shall submit for approval complete details of the system including a layout drawing so that the system furnished can be coordinated in the refurbishing of the building.

END OF SECTION

SECTION 16921
480-VOLT MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install, and test the motor control centers as hereinafter specified and as shown on the Drawings.

1.02 QUALITY ASSURANCE

A. Standards

1. The motor control centers shall be the product of a manufacturer who shall also be the manufacturer of all the circuit breakers, fused switches and motor starters included in the motor control centers.

2. All units and sections shall be UL labeled when possible. Motor control centers containing service entrance equipment shall be UL labeled "Suitable For Use As Service Equipment".

3. Motor control centers shall be built and tested in accordance with:

a. National Electrical Manufacturers (NEMA).
b. American National Standards Institute (ANSI).
c. Underwriters Laboratories, Inc. (UL).

B. Equipment Manufacturer:

1. Square-D.
2. Eaton.
3. Allen Bradley.

1.03 SUBMITTALS

A. Complete master wiring diagrams and elementary or control schematics, including coordination with other electrical control devices operating in conjunction with the motor control centers and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Due to the complexity of the control functions, it is imperative the above drawings be clear and carefully prepared to facilitate interconnections with other equipment.

Standard preprinted sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable.

B. Submittals shall include a bill-of-material listing conductor material and insulation type as well as other hardware and equipment to be furnished.

C. Where it is not explicitly shown and completely obvious from the outline drawings, the following items shall be verified in a written statement accompanying the shop drawings:

1. Type of terminal blocks used and that the removal of plug-in compartments can be performed without disconnecting or removing wires.
2. Tin plating of bus.
3. Insulation and isolation of vertical bus.
4. UL approval.

PART 2 PRODUCTS

2.01 RATING

A. The motor control centers shall be designed for 480-volt, three-phase, three-wire, 60 Hz service and shall have short-circuit rating of not less than 65,000 amperes RMS, symmetrical.

2.02 CONSTRUCTION

A. Structure

1. The motor control centers shall be a standard metal-enclosed, free-standing, deadfront structure, not more than 90-inches in height, and fabricated from formed sheet steel of not less than No. 14 gauge thickness. The enclosure shall be NEMA 1. The motor control centers shall consist of vertical sections of equal height and 20 inches deep containing individual plug-in compartments. Compartments shall be isolated from each other by separate horizontal steel plates or by steel plates without openings that are a part of the compartment itself.
2. Plug-in compartments shall totally isolate enclosed equipment. All unused openings to the adjacent vertical wiring space shall be plugged. All openings used for wiring shall have insulating grommets.
3. Vertical sections shall be mounted on steel channel sills continuous on four sides, or with steel channel sills on two sides and end cover plates. Each compartment shall be provided with a hinged door of pan construction on the front and a door opening of sufficient size to permit ready removal of any of the equipment in the compartment. Interlocks shall be provided to prevent opening the compartment door when the

disconnect device in the compartment is in the closed position. An interlock bypass device shall be furnished. Means of locking the disconnect device in the "Off" position shall be provided. Disconnect device operating mechanism shall not be attached to the compartment door.

4. All sections shall have the same structural features with provisions for the addition of similar sections at either end. Each compartment shall meet NEMA Standards for the control equipment installed and units of similar size shall be interchangeable.
5. Each section shall be provided with a horizontal wiring space which shall line up with a similar space in the adjacent section or sections, with openings between so that wires may be pulled the entire length of the control centers. There shall also be provided in each section a vertical wiring space with separate full height door.
6. The motor control centers shall be designed for against-the-wall mounting. All wiring, bus joints and other mechanical parts requiring tightening or other maintenance shall be accessible from the front or top.
7. The motor control centers shall have engraved laminated nameplates screwed to the doors of each individual compartment and wiring diagrams pasted inside each door. Compartments containing motor starters shall each have an overload heater selection table pasted inside the door.
8. The motor control centers shall provide equipment of type, capacity, trip ratings for the loads shown on the Drawings or otherwise specified.
9. Construction shall be NEMA Class 11, Type B or C. Insofar as possible, all devices and components used shall be of one manufacturer. The motor control centers shall be furnished as a completely factory assembled unit where transportation facilities and installation requirements permit.
10. The motor control centers shall be finished with ANSI Z55.1, No. 61 light gray enamel over a rust resistant primer.
11. The insulation level of the complete motor control assembly shall be such that it will meet the field tests required under PART 3.

B. Buses

1. All buses shall be tin-plated copper. A continuous main horizontal bus shall be furnished. Main buses shall be rated as shown on the Drawings but shall be not less than 600 amperes.
2. Each vertical section shall have a full height vertical bus rated not less than 300 amperes. Vertical buses shall be insulated and isolated with glass polyester or equivalent continuous insulation. Taped buses will not be acceptable. Unused stab openings shall be plugged. Lower ends of vertical buses shall be insulated.
3. A 1/4-inch-x-2-inch ground bus shall be furnished the entire length of the motor control centers.

4. Buses shall be braced for 65,000 amperes RMS, symmetrical, short circuit current.
5. All buses except neutral and ground buses shall be completely isolated by steel plates or insulating material.

C. Wiring

1. All wiring shall be copper.
2. Compartment wiring shall be to compartment mounted, plug-in terminal blocks that allow compartment to be withdrawn without having to remove wires from fixed terminal blocks.
3. Power wiring shall be black. Control wiring shall be red. Wiring energized from sources other than the starter control power transformer shall be yellow. All wiring shall be identified at each termination.

D. Signage

1. Each motor control center shall be furnished with a sign marked "DANGER - HIGH VOLTAGE". Letters shall be not less than l-inch high, 114-inch stroke. Signs shall be laminated plastic, engraved red letters with a white background. Signs shall include voltage (i.e., 480v, 120v, etc.) and be fastened to with stainless steel screws and epoxy cement.
2. All compartments with voltages from sources outside of the compartment, not disconnected by the motor circuit protector, shall have a sign on the compartment door marked "CAUTION - THIS UNIT CONTAINS A VOLTAGE FROM A SOURCE OUTSIDE OF THIS UNIT". Letters shall be black on a high visibility yellow background. Background shall be laminated plastic approximately 3 inches x 5 inches.

2.03 COMPONENTS

A. Variable Frequency Drives

1. Each PWM Variable Frequency Drives shall consist of a 460V, 3 phase rectifier and adjustable frequency inverter with features, functions and options as specified.

2. The Variable Frequency Drives shall be rated for the HP, full load amperes and rpm of the motor. They shall be designed to provide continuous speed adjustment of three-phase motors. The Adjustable Frequency output voltage shall provide constant volts-per-Hertz excitation to the motor terminals up to 60 Hertz.

3. Inverters shall be capable of converting incoming three phase, 460V (±10%) and 60 Hertz (+2) Hertz power to DC bus levels. The DC voltage shall be inverted to an adjustable frequency output.

4. Controllers shall be rated for an ambient temperature of 0°C. to 40°C., an altitude of up to 3,300 feet above sea level and humidity of 0 to 95% non-condensing.

5. All printed circuit boards in the regulator sections shall be completely interchangeable for any rating.

6. The following standard basic control features shall be provided on the inverter:

    a. Start, Stop, "Power On" indicating light and speed control potentiometer. Manual-Off-Remote selector switch. Terminations for remote mounted operator control devices shall be furnished.
    b. Unidirectional operation, coast to rest upon stop.
    c. Full time adjustable torque limit through 100 HP, and adjustable linear independent timed acceleration and deceleration for units larger than 100 HP.
    d. Variable torque performance from 4 to 60 Hertz through 100 HP.
    e. Frequency stability of 0.5% for 24 hours with voltage regulation of +2% of maximum rated output voltage.
    f. LED status indication for Power On, Run, Inverter Enable, Overcurrent, Overvoltage, Overtemperature, Low Supply, and Phase Loss.
    g. 115V AC control power for operator devices and motor space heaters.
    h. Motor slip-dependent speed regulation.
    i. Five cycle logic power carry-over during utility loss.
    j. Phase insensitive to input power.
    k. Automatic restart upon return of power following a utility outage.
    l. AC input main breaker with status contacts.

7. The following standard protective features shall be provided on the drive.

    a. AC input line current limiting fuses for fault current protection of AC to DC converter section and circuit breaker.

b. Electronic overcurrent trip for instantaneous overload protection.
c. Undervoltage and phase loss protection.
d. Over-frequency protection.
e. Over-temperature protection.
f. Incoming surge protection from input AC line transients.
g. Electrical isolation between the power and logic circuits, as well as between the 115V AC control power and the static digital sequencing.
h. Drive to be capable of withstanding output terminal line short circuits without component failure.
i. Di/dt and dv/dt protection for converter semiconductors.

8. The following standard independent adjustments shall be provided on the inverter:

a. Minimum speed - 4 to 40 Hertz.
b. Maximum speed - 40 to 90 Hertz.
c. Acceleration time 2 to 120 sec. and 1 to 30 Hertz per sec.
d. Deceleration time 2 to 120 sec. and 1 to 30 Hertz per sec.
e. Low frequency boost - up to 46 volts and up to 60 volts.
f. Volts per Hertz adjustable from 3.83 to 11.5 volts per Hertz.

9. The following factory installed modifications shall be furnished with the controller:

a. Custom relay for moisture alarm sensing probe for the Reject Pumps only.
b. Isolated process instrument follower input signal of 4-20 mA DC.
c. Process instrument follower input signal 4-20 mA DC.
d. Relay output auxiliary contacts.
e. Door-mounted output load ammeter, voltmeter, and speed output frequency indicating meters, manual speed potentiometer, manual-off-remote selector switch, on/off selector switches.
f. Input power line reactor, dry type, 80°C. rise shall be furnished by VFD manufacture.
g. Provide for motor space heater 120VAC, 150 watts power and control.
h. Output dv/dt filter for motor protection due to long motor leads for all drives.

B. Combination Motor Starters:

1. All motor starters shall be a combination motor circuit protector and contactor, three-pole, 60 Hz, 600-volt, magnetically operated, of the types shown on the Drawings. NEMA sizes shall be as required for the

horsepower shown on the Drawings but shall be not less than NEMA Size 1.

2. All motor starters shall have a 120-volt operating coil, overload relay in each phase and control power transformer.

3. All motor starters shall have 1-N.O. and 1-N.C. auxiliary contacts. Additional auxiliary contacts shall be furnished where shown on the Drawings or as required by the control scheme.

4. Full voltage, non-reversing starters, NEMA Size 4 and smaller shall be of plug-in type design with stab-on connectors engaging the vertical buses. Larger units shall be of fixed design.

5. Reduced-voltage starters shall be solid state type with isolation contactor and surge protection.

    a. Construction

        (1) The power section shall be three phase, 60-hertz, and rated for the HP, current, and voltage as shown on the drawings. It shall consist of three sets of back-to-back phase-controlled power semi-conductors. Maximum current-limit shall be 500% for standard units.
        (2) Resistor/Capacitor snubber networks shall be used to prevent false firing of SCR's due to dv/dt characteristics of the electrical system.
        (3) Fan cooled units shall be supplied with thermal sensors on the heat sink to trip the control protective logic for over temperature condition. Thermal sensors shall be rated 90-degree C maximum.
        (4) The one-piece logic board shall be mounted for easy testing, service and replacement.
        (5) Three-phase current sensing via current transformers for closed loop control to insure motor stability shall be provided.
        (6) A contactor shall be placed on the line side of the starter to automatically isolate the solid-state starter from the line when starter is not energized.

    b. The logic circuitry shall include as a minimum:

        (1) Short circuit electronic trip overcurrent protection. Time not to exceed 1/2 cycle.
        (2) Inverse time running overcurrent protection.

(3) Auxiliary trip circuitry.
(4) Gate firing circuit lockout protection on trip.
(5) Fault relay lockout protection.
(6) 250% - 500% current limit adjustment.
(7) Minimum and maximum voltage adjustments.
(8) Voltage stability adjustment.
(9) Adjustable ramp time (0.5 to 30 seconds).
(10) HAND-OFF-REMOTE selector switch.

c. The logic board shall include, as standard, current and voltage sensing circuitry that continually monitor motor load and regulate motor voltage to minimize motor kWh energy consumption.

d. External interface circuitry shall include 120-volt relay logic interface capability.

e. Tripped functions shall be designed to be cleared by removing power from the solid-state logic board.

f. The solid-state logic shall provide phase sequence protection.

g. Two ground lugs shall be furnished, one for incoming and one for outgoing ground connections.

h. Power terminations shall consist of pressure type terminals for top or bottom entrance.

i. Testing:

(1) The manufacturer shall supply certified test results, upon request, to confirm that the controller has been tested to substantiate designs according to applicable ANSI and NEMA Standards. The tests shall verify not only the performance of the unit and integrated assembly, but also the suitability of the enclosure venting, rigidity and bus bracing. In addition, the unit shall be factory tested in accordance with ANSI standards.
(2) Manufacturer shall be prepared to show proper evidence of having tested for noise immunity on both input and output power connections. Noise testing shall be performed in accordance with NEMA ICA 2-230.40.

6. Overload relays shall be adjustable and manually reset by push button in compartment door. Replaceable individual overload relay heaters of the proper size shall be installed in each phase.

7. Control power transformers shall be sized for additional load where required. Transformer secondary shall be equipped with time-delay fuses.

8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall have auxiliary disconnect contacts when used with starters having external control circuits.

C. Circuit Breakers

1. Circuit breakers shall be thermal-magnetic, molded case, 480-volt, with not less than 65,000 amperes, RMS interrupting capacity. All circuit breakers with 225 amperes frame and larger shall have interchangeable trips. Circuit breakers shall have auxiliary disconnect contacts when used with starters having external control circuits.

D. Control Stations

1. Control stations shall be standard size, heavy-duty, oiltight.

E. Indicating Lights

1. Indicating lights shall be standard size, heavy duty, low voltage transformer operated as manufactured by Square-D type SK-Class 9001 or equal.

F. Running Time Meters

1. Running time meters shall be provided for each starter or drives, 3-1/2-inch-square case; non-reset, 99,999.9 hour range; Type 236 as manufactured by the General Electric Co., or equal.
2. Voltmeters, amp meters, and watt meters shall be 4-1/4-inch square, 250-degree scale, plus or minus l-percent accuracy switchboard instruments; General Electric Co.'s Type AB-40, or equal.
3. A four-position selector switch shall be furnished and installed for selection of three phases and off.

G. Instrument Transformers

1. Instrument transformers shall be indoor, 600-volt, butyl-rubber molded, metering class designed in accordance with ANSI and NEMA standards.

H. Surge Protection

1. Surge protection equipment shall be furnished will 150kA/mode protection.

I. Control Relays

1. Control relays shall be heavy-duty, machine tool type with suitable rated convertible contacts. Time delay relays shall be adjustable.

J. Nameplates

1. Unit nameplates shall be black and white laminated plastic having engraved letters approximately 3/16-inch high extending through the black face into the white layer. Nameplates shall identify equipment controlled or circuit designation as applicable.

2.04 SPARE PARTS

A. The following spare parts shall be furnished:

1. One box of power fuses of each size furnished.
2. One set of starter contacts for each NEMA size installed.
3. One starter coil for each NEMA size installed.
4. One box of pilot lights.

PART 3 EXECUTION

3.01 INSTALLATION

A. The motor control center housings shall be bolted to angle iron sills imbedded in the concrete on the two longest sides. The sills shall be the full length of the motor control center housing and shall be installed level in all directions.

B. Field installed interior wiring shall be neatly grouped by circuit and bound by plastic tie wraps. Circuit groups shall be supported such that circuit termination are not stresses.

C. The motor control centers shall be maintained in an upright position at all times. Lifting shall be only at the floor sills or the top mounted lifting angle.

D. The motor control centers shall be protected against damage at all times. Any damage to the paint shall be carefully repaired using touch-up paint furnished by motor control centers manufacturer.

3.02 TESTS AND CHECKS

A. The following minimum tests and checks shall be made after the assembly of the motor control centers, but prior to the termination of any field wiring.

1. Megger terminals and buses after disconnecting devices sensitive to megger voltage.
2. A 1,000 VDC megger shall be used for these tests.
3. The first test shall be made with main circuit breaker closed and all remaining breakers open. A second test shall be made with all circuit breakers closed.
4. The test results shall be recorded and forwarded to the Engineer for his review. Minimum megger readings shall be 100 megohms in both tests.
5. Test failures will be the Contractors responsibility to correct at no charge to the Owner.

B. The following shall be done before energizing the motor control centers:

1. Remove all current transformer shunts after completing the secondary circuit.
2. Install overload relay heaters based on actual motor nameplate current. If capacitors are installed between starter and motor, use overload relay heaters based on measured motor current.
3. Check all mechanical interlocks for proper operation.
4. Vacuum clean all interior equipment.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF A GEOTECHNICAL SITE EXPLORATION – REVISION 2

COLUMBIA COUNTY NORTH FLORIDA MEGA INDUSTRIAL PARK - PLANT
LAKE CITY, COLUMBIA COUNTY, FLORIDA

GSE PROJECT NO. 14987A

Prepared For:

JONES EDMUNDS, INC.

MARCH 2022

Certificate of Authorization No. 27430

GSE Engineering & Consulting, Inc.

March 25, 2022

Thomas W. Friedrich, PE, BCEE
Senior Consultant / Vice President
Jones Edmunds, Inc.
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Tampa, Florida 33606

Subject: Summary Report of a Geotechnical Site Exploration - Revision 2
Columbia County North Florida Mega Industrial Park - Plant
Lake City, Columbia County, Florida
GSE Project No. 14987A

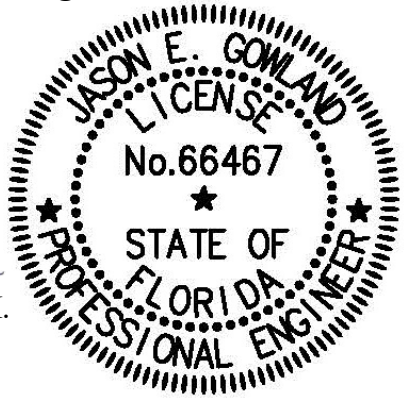
GSE Engineering & Consulting, Inc. (GSE) is pleased to submit this geotechnical site exploration report for the above referenced project.

Presented herein are the findings and conclusions of our exploration, including the geotechnical parameters and recommendations to assist with building and structure foundations, pavement, and stormwater management facility designs. This revision includes additional recommendations for the large tanks.

GSE appreciates this opportunity to have assisted you on this project. If you have any questions or comments concerning this report, please contact us.

Sincerely,

GSE Engineering & Consulting, Inc.



This item has been digitally signed and sealed by

on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Cassandra R. Lindeman, E.I.
Staff Engineer

Jason E. Gowland, P.E.
Senior Engineer
Florida Registration No. 66467

CRL / JEG: hmp
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1. Project Site Location Map
2. Site Plan Showing Approximate Locations of Field Tests

1.0 INTRODUCTION

1.1 General

GSE Engineering & Consulting, Inc. (GSE) has completed this geotechnical exploration for the proposed waste water treatment facility located in Lake City, Columbia County, Florida. This exploration was performed in accordance with GSE Proposal No. 2021-068 dated February 2, 2021. Mr. Stanley F. Ferreira, Jr., P.E., President and CEO, of Jones Edmunds & Associates, Inc. authorized our services on February 15, 2021.

1.2 Project Description

This project will consist of a new waste water treatment facility and a spray irrigation site located in Lake City, Columbia County, Florida (Figure 1). This report includes a geotechnical exploration for the waste water treatment facility. A separate report (GSE Project No. 14978) was issued for the spray field. This revision includes revised settlement estimates for the large (84.5 feet diameter) tanks.

The waste water treatment facility will be located on the south side of SR 10 at the west side of the Columbia Correctional Institute. You provided information about the project and site plans illustrating the locations of the proposed improvements. The waste water treatment facility will include an influent pump station, leachate storage tanks, an Evoqua MLE package WWTP, chlorine contact tanks, clarifier, operations building, 1.5-million-gallon effluent storage pond, a stormwater management facility, and roadways. It is expected that the plant structures will be reinforced concrete design, and the operations building will be conventional CMU or metal frame construction. We anticipate the effluent storage pond will have a synthetic liner. The main entrance road to the site will be paved, and the on-site perimeter road will be stabilized.

The site grades range from about elevation 179 along the east side of the site to 175 feet along the west side of the site. The site will be filled to elevation 181 feet along the east side of the site and have a gentle slope down to elevation 176 feet along the west side. The plant structures will have varying base/foundation elevations. The influent pump station will have a base near elevation 159 feet, or approximately 20 feet below grade. The package plant and chlorine contact tank will be near existing grade near elevation 178 feet. These structures will have water heights of approximately 20 feet, respectively. The pump station will have the base near elevation 166 feet.

A recent aerial photograph of the site was obtained and reviewed. The site plan and aerial photograph were used in preparation of this exploration and report.

1.3 Purpose

The purpose of this geotechnical exploration was to determine the general subsurface conditions, evaluate these conditions with respect to the proposed construction, and prepare geotechnical parameters and recommendations to assist with building foundation and structure, stormwater management, and pavement designs.

2.0 FIELD AND LABORATORY TESTS

2.1 General Description

The procedures used for field sampling and testing are in general accordance with industry standards of care and established geotechnical engineering practices for this geographic region. This exploration consisted of performing ten (10) Standard Penetration Test (SPT) borings to depths of 10 to 80 feet below land surface (bls) at the location of the WWTP structures in accordance with the provided plans, sixteen (16) SPT borings to a depth of 5.5 feet bls along the access roadway alignment and perimeter roadway, three (3) SPT borings to a depth of 20 feet bls along the access roadway alignment, two (2) SPT borings to a depth of 20 feet bls within the proposed stormwater management facility, and two (2) SPT borings to a depth of 40 feet bls at the effluent storage pond.

The soil borings were performed at the approximate locations as shown on Figure 2. The borings were located at the site using the provided site plan, Global Positioning System (GPS) coordinates, and obvious site features as reference. The boring locations should be considered approximate. The soil borings were performed from March 18 through March 25, 2021.

2.2 Auger Borings

The auger borings were performed in accordance with ASTM D1452. The borings were performed with flight auger equipment that was rotated into the ground in a manner that reduces soil disturbance. After penetrating to the required depth, the auger was retracted and the soils collected on the auger flights were field classified and placed in sealed containers. Representative samples of each stratum were retained from the auger boring. Results from the auger borings are provided in Section 5.1.

2.3 Standard Penetration Test Borings

The soil borings were performed with a drill rig employing mud rotary drilling techniques and Standard Penetration Testing (SPT) in accordance with ASTM D1586. The SPTs were performed continuously to 10 feet and at 5-foot intervals thereafter. Soil samples were obtained at the depths where the SPTs were performed. The soil samples were classified in the field, placed in sealed containers, and returned to our laboratory for further evaluation.

After drilling to the sampling depth and flushing the borehole, the standard two-inch O.D. split-barrel sampler was seated by driving it 6 inches into the undisturbed soil. Then the sampler was driven an additional 12 inches by blows of a 140-pound hammer falling 30 inches. The number of blows required to produce the next 12 inches of penetration were recorded as the penetration resistance (N-value). These values and the complete SPT boring logs are provided in Section 5.2.

Upon completion of the sampling, the boreholes were abandoned in accordance with Water Management District guidelines.

2.4 Soil Laboratory Tests

The soil samples recovered from the soil borings were returned to our laboratory, and examined to confirm the field descriptions. Representative samples were then selected for laboratory testing. The laboratory tests consisted of twenty-four (24) percent soil fines passing the No. 200 sieve determinations, twenty-four (24) natural moisture content determinations, and two (2) constant head hydraulic conductivity tests. These tests were performed in order to aid in classifying the soils and to further evaluate their engineering properties. The laboratory tests are provided in Section 5.3.

3.0 FINDINGS

3.1 Surface Conditions

Ms. Cassandra Lindeman, E.I. with GSE visited the site on March 17, 2021 to observe the site conditions and mark the boring locations. Mr. Jason Kite with Jason Kite, LLC was retained by GSE to clear lanes to allow the drilling equipment access to the boring locations.

The site contains both young and mature planted pines with underbrush. The site is bordered by SR 10 to the north. The site is bordered by undeveloped land consisting of planted pines to the west and south, and by the Columbia County Correctional Institute to the east. The Columbia County Soil Survey mapped a wet spot near the southern portion of the site. While clearing and marking the borings, standing water was observed in some locations across the site.

The topography at the site is gently sloping down from the east to the west. Regional topography can be characterized as gently to moderately sloping. The provided site plans indicate the ground surface elevations at the site are near 175 to 179 feet.

3.2 Subsurface Conditions

The locations of the auger and SPT borings are provided on Figure 2. Complete logs for the borings are provided in Sections 5.1 and 5.2. Descriptions for the soils encountered are accompanied by the Unified Soil Classification System symbol (SM, SP-SM, etc.) and are based on visual examination of the recovered soil samples and the laboratory tests performed. Stratification boundaries between the soil types should be considered approximate, as the actual transition between soil types may be gradual.

The borings along the access roadway alignment (B-1 to B-16) encountered relatively consistent soil conditions. Due to accessibility issues, borings B-15 and B-16 were completed with hand auger equipment. The borings generally encountered poorly graded sand (SP), sand with silt (SP-SM), and silty sand (SM) to the explored depths of 5.5 and 20 feet bls.

The borings located in the area of the proposed stormwater management facility (B-17 and B-18) also encountered relatively consistent soil conditions. Boring B-17 encountered 13.5 feet of silty sand (SM) overlying poorly graded sand (SP) to the explored depth of 20 feet bls. Boring B-18 encountered 2.5 feet of sand with silt (SP-SM) underlain by silty clayey sand (SM-SC) and silty sand (SM) to 8.5 feet bls. At 8.5 feet bls, B-18 encountered poorly graded sand (SP) and sand with silt (SP-SM) to the explored depth of 20 feet bls.

The borings located in the area of the proposed effluent storage pond (B-19 and B-20) encountered relatively consistent soil conditions. Boring B-19 generally encountered interbedded layers of poorly graded sand (SP), silty sand (SM), silty clayey sand (SM-SC), and clayey sand (SC) to the explored depth of 55 feet bls. Boring B-20 generally encountered interbedded layers of silty sand (SM), clayey sand (SC), silty clayey sand (SM-SC), and sand with silt (SP-SM) to the explored depth of 40 feet bls.

The borings located within the areas of the perimeter roadway (B-22, B-28, and B-32) generally encountered poorly graded sand (SP), sand with silt (SP-SM), and silty sand (SM) to the explored depth of 5.5 feet bls.

The borings within the areas of the WWTP structures (B-21, B-23 to B-27, B-29 to B-31, B-33) encountered relatively consistent soil conditions. The borings generally encountered interbedded layers of poorly graded sand (SP), sand with silt (SP-SM), silty sand (SM), silty clayey sand (SM-SC), and clayey sand (SC) to the explored depths of 10 to 80 feet bls. Borings B-24, B-25, and B-33 encountered very clayey sand and clays below the sandy materials at depths ranging from 48 to 53 feet bls to the explored depth of 80 feet bls.

The layers of poorly graded sand, sand with silt, and sand with clay are generally in a very loose to very dense condition with N-values ranging from 2 blows per foot to 50 blows for 3 inches. The underlying silty sand, clayey sand, and silty clayey sand layers are generally in a very loose to very dense condition with N-values ranging from 0 blows per foot to 50 blows for 5 inches. The very clayey sand and clay layers encountered are generally in a very soft to very hard condition with N-values ranging from 0 to 50 blows for 1 inch.

Weight-of-hammer soil conditions were encountered in SPT borings B-21 at depths of 48.5 to 49 feet bls and 53.5 to 55 feet bls, B-24 at 43.5 to 44.5 feet bls, and in B-25 at 48.5 to 49 feet bls. Weight-of-rod strength materials were encountered in SPT boring B-23 at a depth of 53.5 to 55 feet bls.

The groundwater table was encountered in the auger and SPT borings. The groundwater table was encountered at the ground surface to a depth of 2.5 feet bls at the time of our investigation.

3.3 Review of Published Data

The majority of the site is mapped as three soil series by the Soil Conservation Service (SCS) Soil Survey for Columbia County[1]. The following soil descriptions are from the Soil Survey.

Hurricane fine sand – This is a somewhat poorly drained, nearly level soil on flats and in areas adjacent to depressions and poorly defined drainageways. The areas range from 10 to 200 acres and are circular to elongated. The slope ranges from 0 to 2 percent.

Typically, the surface layer is very dark gray fine sand about 8 inches thick. The fine sand subsurface layer extends to a depth of 56 inches. The top 10 inches is grayish brown, the next 14 inches is pale brown, and the lower 24 inches is light gray. The subsoil is dark brown fine sand, about 9 inches thick, over black fine sand that extends to a depth of 80 inches or more. The black color of the subsoil is due to the organic matter coating the sand grains.

Included with this soil in mapping are small areas of Albany, Chipley, Leon, Plummer, and Sapelo soils. Also included are soils that are similar to the Hurricane soil but have a loamy subsurface layer. The included soils make up less than 15 percent of the map unit.

This Hurricane soil has a water table at a depth of 20 to 30 inches for 1 to 4 months during most years. Occasionally, it rises above 20 inches for short periods. It recedes to a depth of 45 inches or more during dry periods. The available water capacity is low throughout. Permeability is rapid in the surface and subsurface layers and moderately rapid in the subsoil. Natural fertility is low. The organic matter content is medium in the surface layer, very low in the subsurface layer, and medium in the subsoil.

[1] Soil Survey of Columbia County, Florida. Soil Conservation Service, U.S. Department of Agriculture.

Leon fine sand, 0 to 2 percent slopes – This is a poorly drained, nearly level soil in broad flatwoods and in areas adjacent to wet depressions and drainageways on the uplands. The areas range from 2 to 900 acres and are irregularly shaped. The slope ranges from 0 to 2 percent.

Typically, the surface layer is black fine sand about 8 inches thick. The fine sand subsurface layer extends to a depth of 19 inches and is gray. The fine sand subsoil extends to a depth of 80 inches or more. The upper part of the subsoil extends to a depth of 27 inches. The upper 4 inches is black, and the next 4 inches is very dark brown. This layer is coated with organic matter. The lower part of the subsoil is dark yellowish brown to a depth of 54 inches and, below that, dark brown fine sand over black fine sand that is coated with organic matter.

Included with this soil in mapping are small areas of Electra Variant, Mascotte, Sapelo, Plummer, and Hurricane soils. Also included are small areas of soils that are similar to the Leon soil, but some are in higher positions on the landscape and are better drained and some soils are ponded during wet periods. The included soils make up less than 15 percent of the map unit.

This Leon soil has a water table at a depth of 10 to 40 inches for more than 9 months in most years. The water table is at a depth of less than 10 inches for 1 to 4 months during periods of heavy rains but recedes to a depth of more than 40 inches during very dry seasons. The available water capacity is high in the surface layer, very low in the subsurface layer, medium in the layer between the upper and lower parts of the subsoil, and low in the upper and lower parts of the subsoil.

Permeability is rapid in the surface layer and moderate to moderately rapid in the rest of the soil. Natural fertility is low. The organic matter content is high in the surface layer, moderately low in the subsurface layer, and moderate in the subsoil.

Mandarin fine sand, 0 to 2 percent slopes – This is a somewhat poorly drained, nearly level soil in slightly elevated flatwood areas. The individual areas are mostly irregular in shape and range from 20 to 200 acres. The slope ranges from 0 to 2 percent.

Typically, the surface layer is gray fine sand about 5 inches thick. The subsurface layer is light gray fine sand about 11 inches thick. The upper part of the subsoil is very dark brown, dark reddish brown, and dark brown fine sand that extends to a depth of 26 inches. The sand grains in this layer are well coated with organic matter. The next 7 inches is dark yellowish brown fine sand, and below that, there is light yellowish brown, light gray, and grayish brown fine sand to a depth of 64 inches. The lower part of the subsoil extends to a depth of 80 inches. It is very dark brown fine sand, and the sand grains are coated with organic matter.

Included with this soil in mapping are small areas of Albany, Chipley, Leon, Mascotte, Pelham, Plummer, Hurricane, and Sapelo soils. These soils make up about 15 percent of the map unit.

The water table is at a depth of 20 to 40 inches for 4 to 6 months and at a depth of more than 40 inches for 6 to 8 months. The water table may rise above 20 inches during rainy periods. Permeability is rapid in the surface and subsurface layers and in the layer between the upper and lower parts of the subsoil. It is moderate in the subsoil. The available water capacity and the organic matter content are very low in the surface and subsurface layers and moderate in the subsoil. Natural fertility is very low.

3.4 Laboratory Soil Analysis

Selected soil samples recovered from the soil borings were analyzed for the percent soil fines passing the No. 200 sieve, natural moisture content, and hydraulic conductivity. Samples selected for laboratory testing were collected at depths ranging from 1 to 40 feet bls. These tests were performed to confirm visual soil classification and evaluate their engineering properties. The complete laboratory report is provided in Section 5.3.

The laboratory tests indicate the tested soils consist of poorly graded sand, sand with silt, sand with clay, clayey and silty sand, silty clayey sand, and sandy clay. The tested poorly graded sand (SP) contains approximately 2.8 to 4.9 percent soil fines passing the No. 200 sieve with natural moisture contents of 11 to 25 percent. The tested sand with silt (SP-SM) contains approximately 5 to 11 percent soil fines passing the No. 200 sieve with natural moisture contents of 19 to 24 percent. The tested sand with clay (SP-SC) contains approximately 11 percent soil fines passing the No. 200 sieve with a natural moisture content of 36 percent. The tested silty sand (SM) contains approximately 13 to 39 percent soil fines passing the No. 200 sieve with natural moisture contents of about 23 to 35 percent. The tested clayey sand (SC) contains approximately 13 to 17 percent soil fines passing the No. 200 sieve with natural moisture contents of about 20 to 35 percent. The tested silty clayey sand (SM-SC) contains approximately 21 percent soil fines passing the No. 200 sieve with a natural moisture content of about 18 percent. The tested sandy clay (CL/CH) contains approximately 60 percent soil fines passing the No. 200 sieve with a natural moisture content of about 29 percent.

The constant head hydraulic conductivity test results indicate the tested sand with silt and clayey sand has hydraulic conductivity values of 9 to 12 feet per day.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General

The following recommendations are made based upon our understanding of the proposed construction, a review of the attached soil borings and laboratory test data, and experience with similar projects and subsurface conditions. If plans or the location of proposed construction changes from those discussed previously, GSE requests the opportunity to review and possibly amend our recommendations with respect to those changes.

The final design of a foundation system is dependent upon adequate integration of geotechnical and structural engineering considerations. Consequently, GSE must review the final foundation design in order to evaluate the effectiveness and applicability of our initial analyses, and to determine if additional recommendations may be warranted. Without such a review, the recommendations presented herein could be misinterpreted or misapplied resulting in potentially unacceptable performance of the foundation system.

The performance of site improvements may be sensitive to their post-construction relationship to site groundwater levels, seepage zones, or soil/rock characteristics exposed at final site grades. GSE recommends that use of boring information for final design of all site improvements be predicated on proper horizontal and vertical control of borings.

In this section of the report, we present our geotechnical parameters and recommendations to assist with building and structure foundations, stormwater management, and pavement designs as well as our general site preparation guidelines.

4.2 Groundwater

The groundwater table was encountered in the borings at ground surface to 2.5 feet bls at the time of our exploration. The Soil Survey indicates the groundwater table is typically at a depth of 0.5 to 6 feet bls. We anticipate the seasonal high groundwater table will be at or just below native grades at the boring locations.

4.3 Above Ground Structure Foundations

The soil borings performed indicate the soils across the site are somewhat consistent. The borings typically encountered sandy material consisting of poorly graded sand, sand with silt, silty sand, clayey sand, and silty clayey sand. B-24, B-25, and B-33 encountered very clayey sand, sandy clay, and clay at depths of 48, 49, and 53 feet bls, respectively, to the explored depth of 80 feet bls.

We understand the plant structures will have varying base/foundation elevations. The package plant and chlorine contact tanks will be near existing grade near elevations 178 feet. The groundwater table was encountered in the areas of the WWTP at ground level to approximately 1.3 feet bls. The tank diameters are 84.5 feet in diameter with water heights on the order of 20 feet. GSE has re-evaluated the anticipated settlements of the tanks for a uniform bearing pressure up to 1,500 psf. This revision includes our settlement estimates based on normal site preparation techniques.

Foundation Design Recommendations

Based upon the soil conditions encountered and our limited understanding of the structural loads and site grading, the options presented above for the tank structures, we recommend the above ground structures be supported by conventional, shallow strip and/or spread foundations. We recommend the shallow foundations be designed for a maximum allowable gross bearing pressure of 1,500 psf. The gross bearing pressure is defined as the soil contact pressure that can be imposed from the maximum structural loads, weight of the concrete foundations, weight of the water, and weight of the soil above the foundations. The foundations should be designed based upon the maximum load that could be imposed by all loading conditions.

The foundations should be embedded a minimum of 18 inches below the lowest adjacent grade.

Due to the mostly sandy nature of the majority of the near-surface soils, we expect settlement to be mostly elastic in nature. The majority of the settlement will occur on application of the loads, during and immediately following construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads, and the field and laboratory test data which we have correlated into the strength and compressibility characteristics of the subsurface soils, we estimate the total settlements of the tank structure to be 2 ½ inch or less, with approximately half of it occurring upon load application (during construction).

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. For the tank foundations prepared as recommended, we anticipate differential settlement of less than 1 ¼ inch.

Post-construction settlement of the structures will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundation; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from off-site sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimates for the structure are based upon our limited understanding of the structural loads and site grading and the use of successful adherence to the site preparation recommendations presented later in this report. Any deviation from our project understanding and/or our site preparation recommendations could result in an increase in the estimated post-construction settlement of the structure.

4.4 Influent Pump Station Recommendations

4.4.1 Bearing Soils

The base elevation of the influent pump station will be near elevation 159 feet, approximately 20 feet below grade. It is likely that the pump station will bear in sandy soils. These materials are suitable for foundation support. The excavation for the influent pump station should extend approximately 6 inches deeper than the proposed bottom, and be backfilled with No. 57 stone to create a level working platform. The stone should be spread in maximum 6-inch lifts and tamped with a jumping jack or vibrating plate to consolidate it.

4.4.2 Foundations

Based upon the soil conditions encountered, we recommend a conventional, shallow foundation or a reinforced mat foundation support the pump station. We recommend the influent pump station foundation be designed for a maximum net soil bearing pressure of 4,000 psf. Net bearing pressure is defined as the soil bearing pressure at the base of the foundation in excess of the natural overburden pressure. The foundations should be designed based upon the maximum load that could be imposed by all loading conditions. GSE recommends that the concrete slab surrounding the top of the pump station be designed independently of the pump station to account for slight differential movement.

4.4.3 Lateral Earth Pressures

Lateral earth pressures can be calculated using a hydrostatic pressure distribution from an equivalent fluid having varying densities for various conditions. These values assume sandy soil (clean backfill) with an angle of internal friction of about 28 degrees, a moist unit weight of 105 pounds per cubic foot (pcf), and a saturated unit weight of 120 pcf.

We recommend the backfill soils consist of clean sands with less than 10 percent passing the No. 200 sieve that are compacted to at least 95 percent Modified Proctor maximum dry density. The following parameters consider the recommended backfill soils.

Angle of Internal Friction, $\varphi = 28$ degrees

Active Lateral Earth Pressure Coefficient, $K_a = 0.361$

Passive Lateral Earth Pressure Coefficient, $K_p = 2.77$

At-rest Lateral Earth Pressure Coefficient, $K_o = 0.531$

Unit Weight of Soil (Moist), $\gamma_m = 105$ pounds per cubic foot

Unit Weight of Soil (Submerged), $\gamma_s = 58$ pounds per cubic foot

These values correspond to equivalent fluid densities of 38 pcf, 291 pcf, and 56 pcf for the drained (dry) active, passive, and at-rest conditions, respectively. For undrained (saturated) conditions, these values would correspond to 83 pcf, 223 pcf, and 93 pcf for the undrained active, passive, and at-rest conditions, respectively. The values do not contain a factor of safety. An appropriate factor of safety should be used in the design.

Undrained conditions assume that the full water pressure can develop behind the structure, in addition to the retained earth pressure. Drained conditions assume no hydrostatic (water) pressure can develop due to positive or artificial drainage behind the structure or the absence of a water table and includes only the moist soil earth pressure. GSE recommends the influent pump station design consider a seasonal high-water table near ground surface.

4.4.4 Uplift Resistance

Permanent structures submerged below the water table will be subjected to uplift forces caused by buoyancy. In this case, we recommend you consider the seasonal high groundwater table to be near existing grades to determine buoyant forces. The components resisting this buoyancy include: 1) the total weight of the structure divided by an appropriate safety factor; 2) the buoyant weight of soil surrounding or overlying the structure; and 3) the shearing forces that act on the shear planes that radiate vertically upward from the perimeter of the edges of the structure to the ground surface. The allowable unit shearing resistance may be determined by the following formula:

Allowable Unit Shearing Resistance, $f=K_o\gamma_m h(2/3\tan(\varphi))/FS$ (Above groundwater table)

Allowable Unit Shearing Resistance, $f=K_o(\gamma_m-\gamma_w)h(2/3\tan(\varphi))/FS$ (Below groundwater table)

Where:

f = unit shearing resistance (psf)
φ = Angle of Internal Friction, 28 degrees
K_o = At-rest Lateral Earth Pressure Coefficient, 0.531
γ_m = Unit Weight of Soil (Moist), 105 pcf
γ_w = Unit Weight of Water, 62.4 pcf
h = vertical depth below grade at which shearing resistance is determined
FS = Factor of Safety, 2

The values given for the above parameters assume that the permanent submerged structure is surrounded and covered by clean, compacted granular backfill that extends horizontally a minimum of 2 feet beyond the structure.

4.4.5 Shoring and Bracing

If temporary shoring and bracing is required for any excavation, the system should be designed to resist lateral earth pressure.

The design earth pressure will be a function of the flexibility of the shoring and bracing system. For a flexible system restrained laterally by braces placed as the excavation proceeds, the design pressures for shoring and bracing can be computed using a uniform earth pressure distribution with depth. It is recommended that well points be used to dewater around the excavations. For such dewatered excavations, we recommend using the following uniform pressure distribution over the full braced height as follows:

Uniform Soil Pressure Distribution[2], $p = 0.65\ K_a\gamma_m H$

Where:

p = uniform pressure distribution for design of braced excavation
K_a = At-rest Lateral Earth Pressure Coefficient, 0.361
γ_m = Unit Weight of Soil (Moist), 105 pcf
H = depth of excavation

[2] Joseph E. Bowles *(1977) Foundation Analysis and Design Second Edition,* McGraw Hill, Inc., pg. 456

Lateral pressure distributions determined in accordance with the above do not take hydrostatic pressures or surcharge loads into account. To the extent that such pressures and forces may act on the walls, they should be included in the design. An appropriate factor of safety should be applied for the design of the braced excavation.

Construction equipment and excavated fill should be kept a minimum distance of 5 feet from the edge of the braced or shored excavation. Stockpiled material placed adjacent to (5 feet away from) the braced or shored excavation should have a minimum slope of 2 horizontal to 1 vertical.

4.5 Slab-on-Grade Foundation

The soils encountered within the SPT borings in the areas of the proposed WWTP structures generally encountered sandy materials consisting of poorly graded sand, sand with silt, and silty sand.

We recommend you consider a modulus of subgrade reaction of 100 pounds per square inch should be used for point loading conditions to design the slab-on-grade. The subgrade should be compacted to 95 percent of the maximum Modified Proctor dry density (ASTM D1557). One field density test should be conducted for every 500 square feet of subgrade.

4.6 Flexible Pavement

Overall soil conditions encountered by our borings at this site are suitable for supporting conventional limerock base and asphalt wearing surface pavements. We have not been provided the anticipated traffic loading conditions; therefore, the following pavement component recommendations should be used only as guidelines. The below recommendations are intended to be minimums. Increasing base course and asphalt thicknesses would increase the design life of the pavement.

The seasonal high groundwater table is estimated to be approximately 12 to 24 inches beneath existing grade in some areas of the site. We recommend a minimum of either 12 or 24 inches of separation (depending upon pavement section design) be present between the bottom of the base course and the estimated seasonal high groundwater table. If this separation cannot be achieved by site grading, GSE recommends underdrains be used beneath the base course.

In areas where the minimum 12-to 24-inch separation is not able to be achieved through grading design, we recommend you consider underdrains.

4.6.1 Stabilized Subgrade

If a crushed limerock or recycled concrete base is used, we recommend a stabilized subgrade be located beneath the base. The stabilized subgrade should have a minimum Limerock Bearing Ratio (LBR) of 40, with minimum thicknesses of 6 inches for automobile parking areas and 12 inches for driveways.

The stabilized subgrade can be imported material or a mixture of imported and on-site material. If a mix is proposed, a mix design should be performed to determine the optimum mix proportions. The stabilized subgrade should be compacted to a minimum of 98 percent of the Modified Proctor maximum dry density (ASTM D1557) for soils with less than 15 percent fines content. Soils with 15 percent or greater fines content should be compacted to 100 percent of the Standard Proctor maximum dry density (ASTM D698).

4.6.2 Base Course

The base course can consist of either crushed limerock, soil cement, or recycled concrete. If you should use a soil cement base course, a stabilized subgrade is not required.

Limerock should have a LBR of at least 100, be obtained from a FDOT approved source and meet FDOT gradation requirements. The base course thickness should be a minimum of 6 inches in automobile parking areas, and 8 inches in driveway areas. The base course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D1557). We recommend a minimum 24 inches separation between the bottom of the limerock base course and the estimated seasonal high water table. If site grading does not allow for this separation we recommend underdrains or undercutting be considered.

Soil cement can consist of an imported material or a blend of the on-site soils and cement. A mix design should be performed to determine the optimum cement content. We recommend the soil cement have a minimum 28-day compressive strength of 500 psi. Soil cement can be blended off-site (in a pug mill) or on site. Soil cement pills should be cast from each day's production to verify the recommended compressive strength has been achieved at 28 days. We recommend the soil cement base course be a minimum of 8 inches thick throughout the project. We recommend a minimum 18 inches separation between the bottom of the soil cement base course and the estimated seasonal high water table. If site grading does not allow for this separation we recommend underdrains or undercutting be considered.

Recycled concrete should have a LBR of at least 150, be obtained from a FDOT approved source and meet FDOT gradation requirements. The base course thickness should be a minimum of 8 inches. The base course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D1557). We recommend a minimum 12 inches separation between the bottom of the recycled concrete base course and the estimated seasonal high water table. If site grading does not allow for this separation we recommend underdrains or undercutting be considered.

The constructability of differing base course thicknesses may be difficult, and having a uniform 8-inch-thick base course may be more practical.

4.6.3 Wearing Surface

The asphalt-wearing surface should consist of an FDOT Type SP Hot Mix Asphalt mixture. For automobile parking areas, the thickness should be a minimum of 1.5 inches. For driveway areas, the thickness should be a minimum of 2 inches. The asphalt-wearing surface should consist of an SP-12.5 mix. The asphalt should be compacted to at least 95 percent of the mix design density.

The constructability of differing asphalt thicknesses may be difficult, and having a uniform 2-inch-thick asphalt wearing surface may be more practical.

4.7 Stabilized Roadways

It is likely that the stabilized roadways will be constructed with either native improved soils, limerock, recycled concrete, or asphalt millings. GSE recommends that the stabilized roadways be constructed with a material with a minimum LBR of 40. The materials should be compacted to achieve a minimum density to be determined by the type of material used for construction. GSE recommends the improved roads be designed, constructed and maintained following the *Gravel Roads Construction and Maintenance Guide* published by the FHWA.

4.8 Site Preparation

The soils at this site should be suitable for supporting the proposed construction using normal, good practice site preparation procedures. The following recommendations are our general guidelines for site preparation.

4.8.1 Stripping

Strip the construction limits and 10 feet beyond the perimeter of all grass, roots, topsoil, and other deleterious materials. You should expect to strip to depths of 12 or more inches. Deeper stripping will likely be necessary due to major root systems present at the site.

4.8.2 Dewatering

Temporary dewatering is expected to be necessary for this project. We anticipate dewatering can be accomplished with sumps placed near the construction area, or with underdrains connected to a vacuum pump.

GSE recommends the groundwater table be maintained 2 feet below compaction surfaces to reduce pumping.

The site should always be graded to promote runoff and limit the amount of ponding. Localized ponding of stormwater is expected without proper grading during construction, and could render previously acceptable surfaces unacceptable.

4.8.3 Proof-Rolling

Proof-roll the subgrade with heavy rubber-tired equipment, such as a loaded front-end loader or dump truck, to identify any loose or soft zones not found by the soil borings. The proof-rolling should be monitored by a geotechnical engineer or qualified technician. Undercut or otherwise treat these zones as recommended by the geotechnical engineer in this report.

4.8.4 Proof Compaction

Compact the subgrade to a density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557). The specified compaction should be obtained to a depth of 1 foot below the foundation bottoms and the existing grade prior to placing fill. Vibratory roller equipment should not be used within approximately 100 feet of existing structures. Lighter “walk-behind” compaction equipment may be used to achieve the degree of compaction.

Should clayey sand be encountered at the bearing surface, this material should be probed and visually confirmed to be unyielding in the upper 12 inches in lieu of density testing. If the foundation excavations penetrate the clayey sand, the excavation should be performed in a manner that reduces soil disturbance. Clayey sand soils (with fines content in excess of 15 percent) that are removed and replaced or appreciably disturbed need to be re-compacted to 98 percent of the Standard Proctor maximum dry density (ASTM D698).

4.8.5 Fill Placement

Imported fill placed to raise the site grades should consist of clean sand having less than 10 percent passing the No. 200 sieve. On-site soils meeting the requirements of Section 4.10 may also be used as structural fill. The fill should be placed in maximum 12-inch loose lifts that are compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557). If lighter “walk-behind” compaction equipment is used, this may require lifts of 4 inches or less to achieve the required degree of compaction.

4.9 Quality Control and Construction Materials Testing

It should be noted that the geotechnical engineering design does not end with the advertisement of the construction documents. As the geotechnical engineer of record, GSE is the most qualified to perform the construction materials testing that will be required for this project. The benefits of having the geotechnical engineer of record also perform the construction materials testing are numerous. If GSE continues to be involved with the project through construction, we will be able to constantly re-evaluate and possibly alter our geotechnical recommendations in a timely and cost-effective manner once final design and construction techniques are developed. This often results in cost savings for the project.

We recommend performing compaction testing beneath the concrete slabs and the foundations. We recommend one test be performed every 50 linear feet of continuous footing and every other column footing, per foot depth of fill or native material. We recommend a compaction test be performed for each 500 square feet of slab area per foot of fill or native material, or a minimum of three tests each, whichever is greater. Test all footing excavations to a depth of 12 inches at the frequencies stated above.

4.10 Stormwater Management

The soil conditions at the stormwater management facility are relatively consistent. The borings generally encountered interbedded layers of poorly graded sand, sand with silt, silty sand, and silty clayey sand to the explored depth of 20 feet bls.

The water table was encountered in the SPT borings at depths of 0.25 to 1.6 feet bls at the time of our exploration.

The laboratory permeability tests indicate the surficial layer of sand with silt and clayey sand has hydraulic conductivity values of 9 to 12 feet per day.

Based upon our findings and test results, our recommended soil parameters for the stormwater management design in the explored areas are presented below. The recommended parameters consider the results of the permeability tests, wash 200 determinations, and our experience with these types of soils. The parameters below do not consider a factor of safety.

Proposed Stormwater Management Facility

1. Base elevation of effective or mobilized aquifer (average depth of confining layer) equal to 20 feet bls.
2. Unsaturated vertical infiltration rate of 7 feet per day.
3. Horizontal hydraulic conductivity equal to 10 feet per day.
4. Specific yield (fillable porosity) of 25 percent.
5. Average seasonal high groundwater table depth upper limit equal to 0.3 foot bls.
6. Average seasonal low groundwater table depth equal to 6 feet bls.

4.11 Fill Suitability

The soils encountered at this site within the explored depths range from sands (SP) to clays (CL/CH). A discussion of the suitability for reuse as structural fill for each soil classification according to the Unified Soil Classification System (USCS) designation is provided below.

SP, SP/SM – Sands (SP) and sand with silt (SP/SM) have less than 5 percent and 12 percent soil fines passing the No. 200 sieve, respectively, and are typically well draining soils that are suitable for reuse as structural fill. The sands with silt may require moisture conditioning (drying) to make the material more workable. These soils will require stockpiling and drying before they are reused if they are excavated from below the water table.

SM – Silty sands (SM) can have between 12 percent and 50 percent soil fines passing the No. 200 sieve. Silty sands are typically non-plastic or have low plasticity, and can be reused as structural fill with precautions. Silty sands can be moisture sensitive and difficult to work and compact and can rut if the moisture content is near or above the optimum moisture content. We recommend these soils be moisture conditioned (dried) so that the moisture content during use is at or below the optimum moisture content. Aerating and exposure to the sun is typically the most effective methods of drying these soils. It may not be practical to reuse these materials during the wet season, as frequent rain showers may not allow these soils to dry to a workable moisture content. Suitable silty sands are limited to soil having less than 30 percent soil fines passing the No. 200 sieve. Silty sands with more than 30 percent soil fines are especially moisture sensitive, and are not recommended for reuse as structural fill. These soils will behave more as sandy silt, and for this reason, very silty sands having more than 30 percent soil fines passing the No. 200 sieve have been assigned a dual classification of SM/ML. Silty sand soils that are excavated from below the water table are not recommended for reuse as structural fill due to the amount of time that will be required to dry these soils to a workable condition.

SC – Clayey sand (SC) soils can have between 12 percent and 50 percent soil fines passing the No. 200 sieve. Clayey sands can have a high range of plasticity, varying from a PI of 7 or greater and plotting above the A-line to highly plastic. Friable clayey sands are typically suitable for use as structural fill with precautions. Clayey sands will be moisture sensitive and difficult to work and compact and can rut during placement if the moisture content is near or above the natural moisture content. We recommend these soils be moisture conditioned (dried) so that the moisture content during use is at or below the optimum moisture content. Aerating and exposure to the sun is typically the most effective methods of drying these soils. It may not be practical to reuse these materials during the wet season, as frequent rain showers may not allow these soils to dry to a workable moisture content. Suitable clayey sands are limited to soil having less than 30 percent soil fines passing the No. 200 sieve. Clayey sands with more than 30 percent soil fines passing the No. 200 sieve are especially moisture sensitive and are typically highly plastic, and are not recommended for reuse as structural fill. These soils will behave more as sandy clay, and for this reason, very clayey sands having more than 30 percent soil fines passing the No. 200 sieve have been assigned a dual classification of SC/CH or SC/CL. Clayey sand soils that are excavated from below the water table are not recommended for reuse as structural fill due to the amount of time that will be required to dry these soils to a workable condition.

ML, MH, CL, CH – Silts and clays are not suitable materials for reuse as structural fill.

When using on-site soils as fill materials, we recommend the silty and clayey sand soils (SM, SC) be used in the lower depths of the fill. Sand and sand with silt (SP, SP-SM) should be used in the upper portions of the fill. We recommend a minimum of 2 feet of sand (SP, SP-SM) cover the silty and clayey sand fill materials to reduce the potential for soggy surface conditions due to the low permeability characteristics of the silty and clayey sand materials.

4.12 Surface Water Control and Landscaping

Roof gutters should be considered to divert runoff away from the building. The gutter downspouts should discharge a minimum of 10 feet from the structure to reduce the amount of water collecting around the foundations. Where possible, the gutter downspouts should discharge directly into the storm sewer system or onto the asphalt paved areas in order to reduce the amount of water collecting around the foundations. Grading of the site should be such that water is diverted away from the building on all sides to reduce the potential for erosion and water infiltration along the foundation.

With respect to landscaping, it is recommended that any trees and large "tree-like" shrubbery with potential for developing large root systems be planted a minimum distance of half their mature height, and preferably their expected final height, away from the structure. The purpose of this is to reduce the potential for foundation or slab movements from the growth of root systems as the landscaping matures. Consideration should also be given to using landscaping that has a low water demand, so that excessive irrigation is not conducted around the structures.

5.0 FIELD DATA

5.1 Auger Boring Logs

GSE Engineering & Consulting, Inc.
5590 SW 64th St.
Gainesville, FL 32608
Telephone: (352) 377-3233
Fax: (352) 377-0335

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE PERFORMED 4/15/2021 **BORING NUMBER B-15**

DRILLING CONTRACTOR Whitaker Drilling, Inc.

GROUND WATER LEVELS: LOGGED BY WDI

▼ AT TIME OF DRILLING 2.5 ft CHECKED BY CRL

▽ ESTIMATED SEASONAL HIGH _____

NOTES _____

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0			(SP-SM) Brown and gray SAND with silt
1		AU 1	
2			2.0
		AU 2	(SP) Brown SAND
			2.5
3			(SP) Pale brown SAND
4		AU 3	
5			
			5.5
			Bottom of borehole at 5.5 feet.

DATE PERFORMED 4/15/2021 **BORING NUMBER B-16**

DRILLING CONTRACTOR Whitaker Drilling, Inc.

GROUND WATER LEVELS: LOGGED BY WDI

▼ AT TIME OF DRILLING NE CHECKED BY CRL

▽ ESTIMATED SEASONAL HIGH _____

NOTES _____

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0			(SP-SM) Brown and gray SAND with silt
1		AU 1	
2			2.0
		AU 2	(SP-SM) Gray SAND with silt
3			
4			
5		AU 3	
			5.0
			(SP) Brown SAND
			5.5
			Bottom of borehole at 5.5 feet.

AB 2 PORTRAIT - GINT STD US.GDT - 4/15/21 21:08 - Q:\PROJECTS\14987A COLUMBIA COUNTY, N. FL MEGA INDUSTRIAL PARK - PLANT\14987A BORINGS\14987A BORINGS.GPJ

5.2 Standard Penetration Test Soil Boring Logs

GSE Engineering and Consulting, Inc.
5590 SW 64th St,
Gainesville, FL 32608
Telephone: (352) 377-3233
Fax: (352) 377-0335

BORING NUMBER B-1

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.3 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose gray and brown SAND	2	SPT 1	2-4-6 (10)						
		(SP-SM) Medium dense pale gray and brown SAND with silt		SPT 2	5-6-5 (11)				5.0	19	
5			5	SPT 3	3-3-3 (6)						
		(SM) Loose dark brown silty SAND	5.5								
		Bottom of borehole at 5.5 feet.									

SPT BORINGS - GINT STD US.GDT - 4/30/21 10:29 - Q:\PROJECTS\14987A COLUMBIA COUNTY, N. FL MEGA INDUSTRIAL PARK - PLANT\14987A BORINGS\14987A BORINGS.GPJ

GSE Engineering and Consulting, Inc.
5590 SW 64th St,
Gainesville, FL 32608
Telephone: (352) 377-3233
Fax: (352) 377-0335

BORING NUMBER B-2

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.2 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.2 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose gray SAND									20 40 60 80
		(SP) Medium dense pale brown and gray SAND	1.5	SPT 1	2-3-3 (6)						
				SPT 2	4-6-6 (12)						
5		(SM) Loose dark brown and gray silty SAND	4.5	SPT 3	2-3-4 (7)						
		Bottom of borehole at 5.5 feet.	5.5								

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5590 SW 64th St,
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Fax: (352) 377-0335

BORING NUMBER B-3

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE STARTED 3/18/21 **COMPLETED** 3/18/21 **GROUND ELEVATION** _____ **HOLE SIZE** _____

DRILLING CONTRACTOR Whitaker Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Mud Rotary ▼ **AT TIME OF DRILLING** 0.8 ft

LOGGED BY WDI **CHECKED BY** CRL ▽ **ESTIMATED SEASONAL HIGH** 0.0 ft

NOTES _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		▽ (SP) Very loose to medium dense brown and gray SAND		SPT 1	1-1-1 (2)						20 40 60 80
				SPT 2	4-5-6 (11)						
			3.5								
		(SP) Loose pale brown and gray SAND		SPT 3	3-3-5 (8)						
5			5.5								
		(SP-SM) Medium dense to dense dark brown and gray SAND with silt		SPT 4	4-5-8 (13)						
				SPT 5	6-8-13 (21)				5.5	24	
				SPT 6	15-16-20 (36)						
10			13.5								
		(SP) Very dense brown and orange SAND		SPT 7	16-22-30 (52)						
15			19								
		(SM) Very dense dark brown silty SAND	19.4	SPT 8	24-50/5" 50/5"						>>
		Bottom of borehole at 19.4 feet.									

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BORING NUMBER B-4

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.8 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.8 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Very loose to loose pale brown and gray SAND		SPT 1	1-1-2 (3)						20 40 60 80
				SPT 2	2-3-3 (6)						
5			5	SPT 3	1-2-2 (4)						
		(SM) Very loose dark brown and gray silty SAND	5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-5

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.3 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SM) Loose dark gray and brown silty SAND									20 40 60 80
			2	SPT 1	1-2-3 (5)						
		(SP-SM) Medium dense dark brown and gray SAND with silt		SPT 2	3-12-9 (21)						
			4.5								
5		(SP-SM) Medium dense brown SAND with silt		SPT 3	9-10-10 (20)						
			5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-6

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 2.0 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Gray SAND	0.5								20 40 60 80
		(SP) Loose brown and orange SAND	2	SPT 1	2-2-3 (5)						
		(SP) Loose pale brown and gray SAND	4.5	SPT 2	4-4-5 (9)						
5		(SP-SM) Medium dense dark brown SAND with silt	5.5	SPT 3	4-9-12 (21)						
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-7

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.3 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose gray SAND									20 40 60 80
			2.5	SPT 1	2-3-4 (7)				2.8	11	
		(SP-SM) Loose brown and gray SAND with silt		SPT 2	4-6-6 (12)						
5			5.5	SPT 3	2-3-6 (9)						
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-8

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 2.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 1.5 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Pale gray and brown SAND	1								
		(SP) Loose brown and gray SAND		SPT 1	2-2-5 (7)						
				SPT 2	4-4-5 (9)						
5			5	SPT 3	4-3-4 (7)						
		(SM) Loose to medium dense dark brown and gray silty SAND		SPT 4	4-3-4 (7)						
				SPT 5	4-6-8 (14)						
10				SPT 6	4-7-9 (16)						
			13.5								
		(SP-SM) Very dense dark brown SAND with silt		SPT 7	21-50/3" 50/3"						>>
15											
			18.8	SPT 8	50/3"						>>
		Bottom of borehole at 18.8 feet.									

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BORING NUMBER B-9

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.4 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.4 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Gray SAND	0.5								20 40 60 80
		(SP-SM) Medium dense brown and orange SAND with silt	2	SPT 1	1-6-7 (13)						
		(SP) Loose to medium dense pale brown and gray SAND		SPT 2	4-4-6 (10)						
5			5.5	SPT 3	5-5-7 (12)						
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-10

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.8 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.8 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose to medium dense pale gray and brown SAND									20 40 60 80
				SPT 1	3-3-3 (6)						
				SPT 2	3-6-8 (14)						
5				SPT 3	7-9-11 (20)						
			5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-11

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.5 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose pale gray and brown SAND	2.5	SPT 1	3-4-5 (9)						20 40 60 80
		(SP-SM) Medium dense brown SAND with silt	5	SPT 2	4-5-6 (11)						
5		(SP) Medium dense pale gray and brown SAND	5.5	SPT 3	7-7-5 (12)						
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-12

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.5 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
0		(SM) Loose brown silty SAND									
		(SP) Loose pale gray and brown SAND	1.5	SPT 1	3-4-5 (9)				4.3	25	
				SPT 2	4-5-6 (11)						
5		(SP-SM) Medium dense brown and gray SAND with silt	4.5	SPT 3	7-7-5 (12)						
		Bottom of borehole at 5.5 feet.	5.5								

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BORING NUMBER B-13

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.6 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SM) Very loose gray and brown silty SAND									20 40 60 80
		(SM) Very loose brown silty SAND	1.5	SPT 1	2-2-2 (4)						
		(SM) Very loose to loose pale gray and brown silty SAND	2.5	SPT 2	4-6-4 (10)						
5				SPT 3	1-1-2 (3)						
		Bottom of borehole at 5.5 feet.	5.5								

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BORING NUMBER B-14

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/25/21 **COMPLETED** 3/25/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
▼ **AT TIME OF DRILLING** 0.0 ft
LOGGED BY WDI **CHECKED BY** CRL
▽ **ESTIMATED SEASONAL HIGH** 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SM) Dark brown and gray silty SAND									20 40 60 80
			2.5	SPT 1	2-2-3 (5)						
		(SP-SM) Loose to medium dense brown and orange SAND with silt		SPT 2	5-8-8 (16)						
5			5	SPT 3	4-3-4 (7)						
		(SP-SM) Loose to very dense dark brown and gray SAND with silt		SPT 4	3-3-7 (10)				11	21	
				SPT 5	7-8-24 (32)						
10			10	SPT 6	26-45-50/4" 95/10"						>>
		(SP-SM) Loose to medium dense dark brown SAND with silt									
				SPT 7	4-5-5 (10)						
15											
				SPT 8	5-6-8 (14)						
20			20								
		Bottom of borehole at 20.0 feet.									

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BORING NUMBER B-15

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 4/15/21 **COMPLETED** 4/15/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 2.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 1.5 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
0		(SP-SM) Brown and gray SAND with silt									
1				AU 1							
2			2								
3		(SP) Brown SAND	2.5	AU 2							
4		(SP) Pale brown SAND		AU 3							
5			5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-16

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE STARTED 4/15/21 **COMPLETED** 4/15/21 **GROUND ELEVATION** _____ **HOLE SIZE** _____

DRILLING CONTRACTOR Whitaker Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Mud Rotary ▼ **AT TIME OF DRILLING** NE

LOGGED BY WDI **CHECKED BY** CRL ▽ **ESTIMATED SEASONAL HIGH** 2.0 ft

NOTES _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
0		(SP-SM) Brown and gray SAND with silt		AU 1							
1											
2		▽	2								
		(SP-SM) Gray SAND with silt		AU 2							
3											
4											
5			5	AU 3							
		(SP) Brown SAND	5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-17

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.6 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.6 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SM) Very loose to very dense gray and brown silty SAND		SPT 1	2-2-1 (3)						20 40 60 80
				SPT 2	2-3-5 (8)						
5				SPT 3	3-3-5 (8)						
				SPT 4	10-15-19 (34)						
				SPT 5	15-22-31 (53)						
10				SPT 6	13-19-25 (44)						
			13.5								
		(SP) Medium dense pale brown and gray SAND		SPT 7	5-9-8 (17)						
15											
				SPT 8	5-8-9 (17)						
20			20								
		Bottom of borehole at 20.0 feet.									

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5590 SW 64th St,
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Telephone: (352) 377-3233
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BORING NUMBER B-18

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES _____

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SP-SM) Loose brown SAND with silt								
		2.5	SPT 1	4-4-5 (9)					
	(SP-SC) Loose to medium dense gray and brown silty clayey SAND		SPT 2	1-2-3 (5)					
5			SPT 3	3-4-7 (11)				19	23
		6	SPT 4	9-11-19 (30)					
	(SM) Medium dense to dense gray and brown silty SAND		SPT 5	12-15-21 (36)					
		8.5	SPT 6	12-18-26 (44)					
10	(SP) Dense gray and brown SAND								
		13.5							
	(SP-SM) Medium dense brown SAND with silt		SPT 7	7-9-15 (24)					
15									
		18.5							
	(SP-SM) Medium dense brown and gray SAND with silt	20	SPT 8	6-6-8 (14)					
20	Bottom of borehole at 20.0 feet.								

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-19

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.7 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SM) Very loose to loose dark brown and gray silty SAND		SPT 1	6-4-5 (9)						
				SPT 2	2-1-2 (3)						
		(SM-SC) Medium dense gray silty clayey SAND	4	SPT 3	6-5-9 (14)				21	18	
5				SPT 4	10-9-11 (20)						
				SPT 5	7-9-8 (17)						
10				SPT 6	8-11-12 (23)						
		(SP) Loose pale gray SAND	12								
15				SPT 7	3-3-4 (7)				4.9	23	
20				SPT 8	5-4-6 (10)						

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BORING NUMBER B-19

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(SP) Loose pale gray SAND *(continued)*	23								
25		(SM-SC) Loose brown and gray silty clayey SAND		SPT 9	4-4-5 (9)						
			28								
30		(SP) Medium dense pale brown course SAND		SPT 10	9-6-9 (15)						
			31								
		(SM) Very loose brown and gray very silty SAND with clay	33								
35		(SM) Very loose brown and gray silty SAND		SPT 11	1-0-1 (1)						
40				SPT 12	1-0-0 (0)						
			43								
45		(SM) Very loose gray and green silty SAND with phosphate		SPT 13	3-3-1 (4)						

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BORING NUMBER B-19

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
		(SM) Very loose gray and green silty SAND with phosphate *(continued)*	49.5	SPT 14	1-2-2 (4)						
50		(SC) Dense gray cemented clayey SAND with phosphate									
55			55	SPT 15	10-14-19 (33)						
		Bottom of borehole at 55.0 feet.									

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BORING NUMBER B-20

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/24/21 **COMPLETED** 3/24/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 1.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.5 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SP) Gray SAND	1				
	(SC) Loose brown and orange clayey SAND		SPT 1	2-3-3 (6)		
			SPT 2	4-3-3 (6)	14	24
		4				
	(SP-SM) Loose to medium dense gray and brown SAND with silt		SPT 3	4-4-3 (7)		
5			SPT 4	10-12-17 (29)		
			SPT 5	10-12-14 (26)		
			SPT 6	12-12-15 (27)	9.6	22
10		13				
	(SP-SM) Loose dark brown and tan SAND with silt		SPT 7	3-4-5 (9)		
15						
		18				
	(SM) Loose to medium dense pale brown and gray silty SAND		SPT 8	3-4-6 (10)		
20						

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-20

CLIENT Jones Edmunds & Associates, Inc.

PROJECT NAME Columbia County NFMIP

PROJECT NUMBER 14987A

PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
		(SM) Loose to medium dense pale brown and gray silty SAND *(continued)*									
25				SPT 9	9-12-9 (21)						
			28								
		(SP-SM) Dense brown and gray SAND with silt									
30				SPT 10	10-14-17 (31)						
			33								
		(SM-SC) Loose gray and brown silty clayey SAND									
35				SPT 11	2-2-4 (6)						
			38								
		(SP) Medium dense pale brown silty clayey SAND with phosphate									
40			40	SPT 12	6-6-7 (13)						
		Bottom of borehole at 40.0 feet.									

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BORING NUMBER B-21

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/22/21 **COMPLETED** 3/22/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
▼ **AT TIME OF DRILLING** NE
LOGGED BY WDI **CHECKED BY** CRL
▽ **ESTIMATED SEASONAL HIGH** 1.5 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)
0	(SM) Dark gray and brown silty SAND			
			SPT 1	1-2-2 (4)
		2.5		
	(SP-SM) Loose gray and pale brown SAND with silt		SPT 2	2-2-4 (6)
5			SPT 3	4-5-4 (9)
		6		
	(SM) Medium dense dark brown silty SAND		SPT 4	8-9-18 (27)
			SPT 5	6-9-11 (20)
10			SPT 6	8-11-13 (24)
		13		
	(SM) Medium dense brown and gray silty SAND		SPT 7	11-15-15 (30)
15				
		18		
	(SP-SM) Medium dense pale brown and gray SAND with silt		SPT 8	10-10-15 (25)
20				

LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX | PERCENT PASS NO. 200 SIEVE | MOISTURE CONTENT, %

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-21

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(SP-SM) Medium dense pale brown and gray SAND with silt *(continued)*	23								
25		(SM) Medium dense brown and gray silty SAND		SPT 9	9-8-12 (20)						
			28								
30		(SM) Medium dense pale gray and brown silty SAND with phosphate		SPT 10	6-10-12 (22)						
35			35	SPT 11	11-12-14 (26)						
		(SM) Medium dense brown and orange silty SAND with traces of clay	38								
40		(SM-SC) Very loose brown and gray silty clayey SAND		SPT 12	1-1-1 (2)						
45				SPT 13	1-1-2 (3)						

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BORING NUMBER B-21

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
50		(SM-SC) Very loose brown and gray silty clayey SAND *(continued)*		SPT 14	0-1-2 (3)						
			53								
55		(SM-SC) Very loose green and brown silty clayey SAND		SPT 15	0-0-0 (0)						
			58								
60		(SP) Medium dense green and gray SAND with phosphate	60	SPT 16	5-8-11 (19)						
		Bottom of borehole at 60.0 feet.									

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BORING NUMBER B-22

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.7 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose pale gray SAND									20 40 60 80
			2	SPT 1	4-4-6 (10)						
		(SM) Medium dense dark brown silty SAND		SPT 2	6-9-18 (27)						
5			5	SPT 3	6-7-12 (19)						
		(SP-SM) Medium dense brown and orange SAND with silt	5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-23

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE STARTED 3/18/21 **COMPLETED** 3/18/21 **GROUND ELEVATION** _____ **HOLE SIZE** _____

DRILLING CONTRACTOR Whitaker Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Mud Rotary ▼ **AT TIME OF DRILLING** NR

LOGGED BY WDI **CHECKED BY** CRL ▽ **ESTIMATED SEASONAL HIGH** 1.5 ft

NOTES _____

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)
0	(SM) Loose dark gray silty SAND		SPT 1	4-4-4 (8)
		2.5	SPT 2	6-4-4 (8)
	(SP-SM) Loose to medium dense brown and orange SAND with silt		SPT 3	3-4-9 (13)
5		6	SPT 4	5-7-9 (16)
	(SM) Medium dense to very dense dark brown silty SAND		SPT 5	12-20-50/4" 70/10"
			SPT 6	17-28-36 (64)
10		13		
	(SP-SM) Dense dark brown and gray SAND with silt		SPT 7	18-25-24 (49)
15		19	SPT 8	12-10-17 (27)
	(SM) Medium dense brown and orange silty SAND			
20				

LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX | PERCENT PASS NO. 200 SIEVE | MOISTURE CONTENT, %

▲ SPT N VALUE ▲

20 40 60 80

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BORING NUMBER B-23

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
	(SM) Medium dense brown and orange silty SAND *(continued)*	23							
25	(SM) Dense brown, gray and orange very silty SAND		SPT 9	14-22-21 (43)					
		28						35	39
30	(SP-SM) Dense pale brown an orange fine SAND with silt		SPT 10	9-17-21 (38)					
		33							
35	(SP) Medium dense pale brown, gray and orange SAND		SPT 11	17-17-13 (30)					
		38							
40	(SC-SM) Very loose gray and brown clayey SAND with silt		SPT 12	3-0-2 (2)					
		43							
45	(SM) Very loose green and gray silty SAND		SPT 13	1-2-1 (3)					

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-23

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(SM) Very loose green and gray silty SAND *(continued)*	48								
50		(SC) Very loose green phospherouse clayey SAND		SPT 14	1-1-1 (2)						
			53								
55		(SC) Very loose green and tan clayey SAND *Weight-of-rod from 53.5 to 55 ft bls*		SPT 15	0-0-0 (0)						
			58								
60		(SP-SC) Medium dense green and gray SAND with clay and phosphate	60	SPT 16	4-5-9 (14)						
		Bottom of borehole at 60.0 feet.									

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BORING NUMBER B-24

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/19/21 **COMPLETED** 3/19/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.5 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SM) Loose brown silty SAND	2.5	SPT 1	1-2-4 (6)					
	(SP-SM) Loose gray SAND with silt	4.5	SPT 2	4-3-2 (5)					
5	(SP-SM) Loose to very dense dark brown and orange SAND with silt	7	SPT 3	2-3-5 (8)					
			SPT 4	16-32-50/4" 82/10"					
	(SP-SM) Dense brown and gray SAND with silt		SPT 5	20-18-20 (38)				22	9.7
10			SPT 6	7-17-22 (39)					
		12							
	(SP) Medium dense pale brown SAND		SPT 7	6-7-11 (18)					
15									
		18							
	(CL/CH) Medium dense pale broand and gray sandy CLAY with traces of silt		SPT 8	8-8-14 (22)				29	60
20									

▲ SPT N VALUE ▲
20 40 60 80
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BORING NUMBER B-24

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)
	(CL/CH) Medium dense pale broand and gray sandy CLAY with traces of silt *(continued)*	23		
	(SM) Medium dense gray brown silty SAND		SPT 9	15-18-18 (36)
25		28		
	(SP-SM) Medium dense gray SAND with silt		SPT 10	6-6-5 (11)
30		33		
	(SM-SC) Very loose gray silty clayey SAND		SPT 11	1-1-1 (2)
35		38		
	(SM-SC) Very loose green and gray very silty clayey SAND		SPT 12	1-1-1 (2)
40		43		
	(SC/CL) Very loose gray and green very clayey SAND with phosphate		SPT 13	0-0-1 (1)
45	*Weight of hammer from 43.5 to 44.5 feet.*			

LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX | PERCENT PASS NO. 200 SIEVE | MOISTURE CONTENT, %

▲ SPT N VALUE ▲
20 40 60 80

SPT BORINGS - GINT STD US.GDT - 4/30/21 10:29 - Q:\PROJECTS\14987A COLUMBIA COUNTY, N. FL MEGA INDUSTRIAL PARK - PLANT\14987A BORINGS\14987A BORINGS.GPJ

(Continued Next Page)

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BORING NUMBER B-24

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
		(SC/CL) Very loose gray and green very clayey SAND with phosphate *(continued)*	48								
50		(SC) Very loose green and gray very clayey SAND with phosphate		SPT 14	1-0-0 (0)						
			53								
55		(CL/CH) Very stiff green and gray sandy CLAY		SPT 15	8-6-10 (16)						
			58								
60		(SC/CL) Very dense green and gray very clayey SAND with phosphate		SPT 16	9-22-28 (50)						
			63								
65		(CL/CH) Hard green CLAY with phosphate		SPT 17	17-23-25 (48)						
			68								
70		(CL/CH) Hard to very hard green CLAY		SPT 18	32-30-35 (65)						

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BORING NUMBER B-24

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(CL/CH) Hard to very hard green CLAY *(continued)*									
75				SPT 19	14-17-20 (37)						
80			80	SPT 20	12-14-22 (36)						
		Bottom of borehole at 80.0 feet.									

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BORING NUMBER B-25

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.7 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Gray SAND with silt	1								
		(SM) Very loose to loose brown silty SAND		SPT 1	2-2-3 (5)						
				SPT 2	1-1-1 (2)						
			4								
		(SM) Medium dense dense gray and brown silty SAND		SPT 3	4-6-10 (16)						
5				SPT 4	9-11-16 (27)						
				SPT 5	12-14-18 (32)						
				SPT 6	10-9-9 (18)						
10											
			13								
		(SP-SM) Medium dense pale brown, gray and orange SAND with silt		SPT 7	8-10-12 (22)						
15											
			18								
		(SP) Medium dense pale gray and orange SAND		SPT 8	6-8-8 (16)				22	6.8	
20											

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BORING NUMBER B-25

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
		(SP) Medium dense pale gray and orange SAND *(continued)*									
25				SPT 9	10-15-12 (27)						
			28								
		(SM) Medium dense pale brown and gray silty SAND									
30				SPT 10	9-8-5/4" 13/10"						>>
			33								
		(SC) Very loose gray clayey SAND									
35				SPT 11	1-2-1 (3)				35	14	
				SPT 12	1-1-1 (2)						
40											
				SPT 13	1-0-0 (0)						
45											

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BORING NUMBER B-25

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
	(SC) Very loose gray clayey SAND *(continued)*									
	Weight of hammer at 48.5 ft	49	SPT 14	0-18-28 (46)						
50	(SC/CL) Hard green and gray very clayey SAND									
		53.5	SPT 15	50/1"						>>
55	(CL/CH) Very hard dark gray cemented CLAY									
			SPT 16	50/3"						>>
60										
			SPT 17	50/1"						>>
65										
		66.5								
	(CL/CH) Very stiff to very hard gray and green CLAY with sand									
			SPT 18	8-11-14 (25)						
70										

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BORING NUMBER B-25

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(CL/CH) Very stiff to very hard gray and green CLAY with sand *(continued)*									
				SPT 19	10-12-19 (31)						
75											
				SPT 20	14-19-24 (43)						
80			80								
		Bottom of borehole at 80.0 feet.									

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BORING NUMBER B-26

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE STARTED 3/24/21 **COMPLETED** 3/24/21 **GROUND ELEVATION** _____ **HOLE SIZE** _____

DRILLING CONTRACTOR Whitaker Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Mud Rotary **AT TIME OF DRILLING** 0.5 ft

LOGGED BY WDI **CHECKED BY** CRL **ESTIMATED SEASONAL HIGH** 0.0 ft

NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0	(SP-SM) Loose gray and pale brown SAND with silt		SPT 1	2-2-3 (5)						
		2.5								
	(SM) Very loose to very dense gray and brown silty SAND		SPT 2	4-1-1 (2)						
5		5	SPT 3	11-34-49 (83)						
	(SP-SM) Very dense dark brown SAND with silt	6	SPT 4	50/5"						
	(SM) Dense to very dense dark brown and gray silty SAND		SPT 5	14-22-40 (62)				33	13	
10			SPT 6	28-26-42 (68)						
15			SPT 7	22-22-16 (38)						
		17								
	(SP-SM) Medium dense brown and orange SAND with silt		SPT 8	7-8-11 (19)						
20										

SPT N VALUE scale: 20 40 60 80; >>

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BORING NUMBER B-26

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ (20 40 60 80)
		(SM) Medium dense pale brown and orange silty SAND	22								
25				SPT 9	11-10-8 (18)						
			28								
		(SP-SM) Medium dense brown, gray and orange SAND with silt									
30				SPT 10	6-11-15 (26)						
			33								
		(SM-SC) Very loose gray and brown silty clayey SAND									
35				SPT 11	1-2-2 (4)						
40				SPT 12	1-1-1 (2)						
			43								
		(SC) Loose gray and tan clayey SAND with phosphate									
45			45	SPT 13	2-4-6 (10)						
		Bottom of borehole at 45.0 feet.									

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BORING NUMBER B-27

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING Ground Level
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP-SM) Very loose to loose gray and brown SAND with silt		SPT 1	1-2-2 (4)				21	7.1	
				SPT 2	4-3-2 (5)						
			4.5	SPT 3	2-2-4 (6)						
5		(SM) Loose to dense dark brown silty SAND		SPT 4	2-3-4/0" 3/0"						>>
				SPT 5	6-9-14 (23)						
10			10	SPT 6	8-11-18 (29)						
		Bottom of borehole at 10.0 feet.									

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BORING NUMBER B-28

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.8 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP-SM) Medium dense gray SAND with silt	1.5								20 40 60 80
		(SM) Medium dense brown silty SAND		SPT 1	6-6-5 (11)						
				SPT 2	8-10-11 (21)						
			4.5								
5		(SM-SC) Medium dense pale brown and gray silty SAND with clay		SPT 3	8-9-15 (24)						
			5.5								
		Bottom of borehole at 5.5 feet.									

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BORING NUMBER B-29

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/24/21 **COMPLETED** 3/24/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING Ground Level
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SP-SM) Loose brown and gray SAND with silt		SPT 1	5-5-4 (9)					
		2.5							
	(SP-SM) Loose brown and orange SAND with silt		SPT 2	4-4-4 (8)					
		4							
	(SP-SM) Loose to dense gray and brown SAND with silt		SPT 3	7-10-13 (23)					
5			SPT 4	6-16-19 (35)				21	11
			SPT 5	26-28-30 (58)					
10			SPT 6	22-22-25 (47)					
15			SPT 7	2-4-6 (10)					
		18.5							
	(SP) Loose pale brown and tan SAND		SPT 8	2-3-4 (7)					
20									

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-29

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(SP) Loose pale brown and tan SAND *(continued)*	23								
		(SM) Loose pale brown silty SAND		SPT 9	4-4-2 (6)						
25											
			28								
		(SP) Medium dense pale brown, gray and orange SAND		SPT 10	7-9-8 (17)						
30											
			33								
		(SM-SC) Very loose gray silty clayey SAND		SPT 11	1-0-1 (1)						
35											
			38								
		(SC) Loose gray and brown clayey SAND		SPT 12	2-3-4 (7)						
40			40								
		Bottom of borehole at 40.0 feet.									

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BORING NUMBER B-30

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/23/21 **COMPLETED** 3/23/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP) Loose gray SAND									
			1.5	SPT 1	4-4-5 (9)						
		(SP-SM) Loose to medium dense brown SAND with silt		SPT 2	4-4-3 (7)				20	8.4	
			4								
5		(SM) Medium dense pale gray and brown silty SAND		SPT 3	2-3-3 (6)						
				SPT 4	6-6-15 (21)						
				SPT 5	12-12-19 (31)						
10				SPT 6	10-12-16 (28)						
			13.5								
		(SP-SM) Medium dense brown and orange SAND with silt		SPT 7	7-8-8 (16)						
15											
				SPT 8	8-12-14 (26)						
20			20								
		Bottom of borehole at 20.0 feet.									

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BORING NUMBER B-31

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.3 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)
0	(SP) Very loose to loose pale brown and gray SAND		SPT 1	3-4-6 (10)
			SPT 2	4-3-1 (4)
		4.5	SPT 3	2-3-2 (5)
5	(SP-SM) Loose brown SAND with silt		SPT 4	2-3-6 (9)
		6.5	SPT 5	4-6-16 (22)
	(SM) Medium dense to dense dark brown silty SAND		SPT 6	8-12-19 (31)
10				
		13.5		
	(SP-SM) Medium dense brown and orange SAND with silt		SPT 7	8-11-9 (20)
15				
			SPT 8	10-9-13 (22)
20		20		
	Bottom of borehole at 20.0 feet.			

LIQUID LIMIT, % | PLASTIC LIMIT, % | PLASTICITY INDEX | PERCENT PASS NO. 200 SIEVE | MOISTURE CONTENT, %

▲ SPT N VALUE ▲
20 40 60 80

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BORING NUMBER B-32

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida
DATE STARTED 3/18/21 **COMPLETED** 3/18/21
GROUND ELEVATION _____ **HOLE SIZE** _____
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Mud Rotary
AT TIME OF DRILLING 0.7 ft
LOGGED BY WDI **CHECKED BY** CRL
ESTIMATED SEASONAL HIGH 0.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		(SP-SM) Gray SAND with silt	1								
		(SP-SM) Loose brown SAND with silt	3	SPT 1	4-4-4 (8)						
		(SP-SM) Medium dense gray and brown SAND with silt	4.5	SPT 2	6-5-6 (11)						
5		(SM) Loose gray and brown silty SAND	5.5	SPT 3	3-2-3 (5)						
		Bottom of borehole at 5.5 feet.									

SPT BORINGS - GINT STD US.GDT - 4/30/21 10:29 - Q:\PROJECTS\14987A COLUMBIA COUNTY, N. FL MEGA INDUSTRIAL PARK - PLANT\14987A BORINGS\14987A BORINGS.GPJ

GSE Engineering and Consulting, Inc.
5590 SW 64th St,
Gainesville, FL 32608
Telephone: (352) 377-3233
Fax: (352) 377-0335

BORING NUMBER B-33

CLIENT Jones Edmunds & Associates, Inc. **PROJECT NAME** Columbia County NFMIP

PROJECT NUMBER 14987A **PROJECT LOCATION** Lake City, Columbia, Florida

DATE STARTED 3/25/21 **COMPLETED** 3/25/21 **GROUND ELEVATION** _____ **HOLE SIZE** _____

DRILLING CONTRACTOR Whitaker Drilling, Inc. **GROUND WATER LEVELS:**

DRILLING METHOD Mud Rotary ▼ **AT TIME OF DRILLING** 1.3 ft

LOGGED BY WDI **CHECKED BY** CRL ▽ **ESTIMATED SEASONAL HIGH** 0.3 ft

NOTES _____

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲
0		▽ (SP) Gray SAND	1								20 40 60 80
		▼ (SP-SM) Loose brown and orange SAND with silt	2.5	SPT 1	2-2-3 (5)						
		(SP) Medium dense pale brown and orange SAND	4.5	SPT 2	4-5-8 (13)						
5		(SC) Loose to very dense gray clayey SAND	7	SPT 3	3-4-4 (8)				23	17	
				SPT 4	9-28-44 (72)						
		(SP-SM) Very dense brown and gray SAND with silt		SPT 5	10-19-44 (63)						
10				SPT 6	18-22-34 (56)						
			13								
		(SM) Loose pale brown and gray silty SAND		SPT 7	4-3-4 (7)						
15											
			18								
		(SM) Medium dense pale brown and gray silty SAND		SPT 8	6-6-9 (15)						
20											

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BORING NUMBER B-33

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
	(SM) Medium dense pale brown and gray silty SAND *(continued)*	23							
25	(SM) Medium dense pale brown, gray and orange silty SAND		SPT 9	2-9-16 (25)					
		28							
30	(SP-SM) Very dense pale brown and gray SAND with silt		SPT 10	17-28-50/4" 78/10"					
		33							
35	(SM-SC) Loose gray and brown silty clayey SAND		SPT 11	1-2-3 (5)					
		38							
40	(SP-SC) Loose to dense dark gray SAND with clay		SPT 12	4-5-5 (10)				36	11
45			SPT 13	15-16-23 (39)					

▲ SPT N VALUE ▲
20 40 60 80
>>

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BORING NUMBER B-33

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PROJECT NAME Columbia County NFMIP
PROJECT NUMBER 14987A
PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(SP-SC) Loose to dense dark gray SAND with clay *(continued)*	48								
50		(SC) Very dense pale gray and green clayey SAND with phosphate		SPT 14	18-26-40 (66)						
			53								
55		(CL/CH) Hard to very hard green and gray sandy CLAY with phosphate		SPT 15	28-36-40 (76)						
60				SPT 16	14-23-12 (35)						
			63								
65		(CL/CH) Medium dense to dense green sandy CLAY with phosphate		SPT 17	12-19-23 (42)						
70				SPT 18	7-6-9 (15)						

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BORING NUMBER B-33

CLIENT Jones Edmunds & Associates, Inc.
PROJECT NAME Columbia County NFMIP
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PROJECT LOCATION Lake City, Columbia, Florida

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %	▲ SPT N VALUE ▲ 20 40 60 80
		(CL/CH) Medium dense to dense green sandy CLAY with phosphate *(continued)*									
75				SPT 19	8-9-9 (18)						
80			80	SPT 20	9-10-13 (23)						
		Bottom of borehole at 80.0 feet.									

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5.3 Laboratory Results

GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF LABORATORY TEST RESULTS

Project Number: 14987A

Project Name: Columbia County, NFMIP - Plant

Boring Number	Depth (ft)	Soil Description	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Organic Content (%)	Hydraulic Conductivity (ft/day)	Unified Soil Classification
B-1	2.5 - 4	Gray and brown SAND with silt	19				5.0			SP-SM
B-3	7 - 8.5	Dark brown and gray SAND with silt	24				5.5			SP-SM
B-7	1 - 2.5	Gray SAND	11				2.8			SP
B-12	1 - 2.5	Pale gray and brown SAND	25				4.3			SP
B-14	5.5 - 7	Dark brown and gray SAND with silt	21				11			SP-SM
B-17	4-6	Gray and brown SAND with silt	19				11		9.0	SP-SM
B-18	2-4	Gray and brown silty clayey SAND	20				13		12	SC
B-18	4 - 5.5	Gray and brown silty clayey SAND	23				19			SM
B-19	4 - 5.5	Gray silty clayey SAND	18				21			SM-SC
B-19	13.5 - 15	Pale gray SAND	23				4.9			SP
B-20	2.5 - 4	Brown and orange clayey SAND	24				14			SC
B-20	8.5 - 10	Gray and brown SAND with silt	22				9.6			SP-SM

GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF LABORATORY TEST RESULTS

Project Number: 14987A

Project Name: Columbia County, NFMIP - Plant

Boring Number	Depth (ft)	Soil Description	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Organic Content (%)	Hydraulic Conductivity (ft/day)	Unified Soil Classification
B-21	4 - 5.5	Gray and pale brown SAND with silt	19				9.5			SP-SM
B-23	23.5 - 25	Brown and orange very silty SAND	35				39			SM
B-24	7 - 8.5	Brown and gray SAND with silt	22				10			SP-SM
B-24	18.5 - 20	Pale brown and gray sandy CLAY with trace silt	29				60			CL/CH
B-25	18.5 - 20	Pale gray and orange SAND with silt	22				6.8			SP-SM
B-25	33.5 - 35	Gray clayey SAND	35				14			SC
B-26	7 - 8.5	Dark brown and gray silty SAND	33				13			SM
B-27	1 - 2.5	Gray and brown SAND with silt	21				7.1			SP-SM
B-29	5.5 - 7	Gray and brown SAND with silt	21				11			SP-SM
B-30	2.5 - 4	Brown SAND with silt	20				8.4			SP-SM
B-33	4 - 5.5	Gray clayey SAND	23				17			SC
B-33	38.5 - 40	Dark gray SAND with clay	36				11			SP-SC

5.4 Key to Soil Classification

KEY TO SOIL CLASSIFICATION CHART

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				SYMBOLS		GROUP NAME
				GRAPHIC	LETTER	
COARSE-GRAINED SOILS	Gravels	Clean Gravels	Cu ≥ 4 and 1 ≤ Cc ≤ 3		**GW**	Well graded GRAVEL
More than 50% retained on No. 200 sieve	More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines	Cu < 4 and/or 1 > Cc > 3		**GP**	Poorly graded GRAVEL
		Gravels with fines	Fines classify as ML or MH		**GM**	Silty GRAVEL
		More than 12% fines	Fines classify as CL or CH		**GC**	Clayey GRAVEL
	Sands	Clean Sands	Cu ≥ 6 and 1 ≤ Cc ≤ 3		**SW**	Well graded SAND
	50% or more of coarse fraction passes No. 4 sieve	Less than 5% fines	Cu < 6 and/or 1 > Cc > 3		**SP**	Poorly graded SAND
		Sand with fines	Fines classify as ML or MH		**SP-SM**	SAND with silt
		5% ≤ fines < 12%	Fines classify as CL or CH		**SP-SC**	SAND with clay
		Sand with fines	Fines classify as ML or MH		**SM**	Silty SAND
		12% ≤ fines < 30%	Fines classify as CL or CH		**SC**	Clayey SAND
		Sand with fines	Fines classify as ML or MH		**SM**	Very silty SAND
		30% fines or more	Fines classify as CL or CH		**SC**	Very clayey SAND
FINE-GRAINED SOILS	Clays	inorganic	50% ≤ fines < 70%		**CL/CH**	Sandy CLAY
50% or more passes the No. 200 sieve			70% ≤ fines < 85%		**CL/CH**	CLAY with sand
			fines ≥ 85%		**CL/CH**	CLAY
	Silts and Clays	inorganic	PI > 7 and plots on/above "A" line		**CL**	Lean CLAY
	Liquid Limit less than 50		PI < 4 or plots below "A" line		**ML**	SILT
		organic	Liquid Limit - oven dried / Liquid Limit - not dried < 0.75		**OL**	Organic clay / Organic silt
	Silts and Clays	inorganic	PI plots on or above "A" line		**CH**	Fat CLAY
	Liquid Limit 50 or more		PI plots below "A" line		**MH**	Elastic SILT
		organic	Liquid Limit - oven dried / Liquid Limit - not dried < 0.75		**OH**	Organic clay / Organic silt
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor				**PT**	PEAT

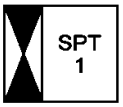
CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	No. OF BLOWS, N	RELATIVE DENSITY
	0 - 4	Very Loose
	5 - 10	Loose
SANDS:	11 - 30	Medium dense
	31 - 50	Dense
	OVER 50	Very Dense

	No. OF BLOWS, N	CONSISTENCY
	0 - 2	Very Soft
SILTS	3 - 4	Soft
&	5 - 8	Firm
CLAYS:	9 - 15	Stiff
	16 - 30	Very Stiff
	31 - 50	Hard
	OVER 50	Very Hard

	No. OF BLOWS, N	RELATIVE DENSITY
	0 - 8	Very Soft
	9 - 18	Soft
LIMESTONE:	19 - 32	Moderately Hard
	33 - 50	Hard
	OVER 50	Very Hard

SAMPLE GRAPHIC TYPE LEGEND



Location of SPT Sample



Location of Auger Sample

PARTICLE SIZE IDENTIFICATION

BOULDERS:		Greater than 300 mm
COBBLES:		75 mm to 300 mm
GRAVEL:	Coarse -	19.0 mm to 75 mm
	Fine -	4.75 mm to 19.0 mm
SANDS:	Coarse -	2.00 mm to 4.75 mm
	Medium -	0.425 mm to 2.00 mm
	Fine -	0.075 mm to 0.425 mm
SILTS & CLAYS:		Less than 0.075 mm

LABORATORY TEST LEGEND

LL	=	Liquid Limit, %
PL	=	Plastic Limit, %
PI	=	Plasticity Index, %
% PASS - 200	=	Percent Passing the No. 200 Sieve
MC	=	Moisture Content, %
ORG	=	Organic Content, %
k_h	=	Horizontal Hydraulic Conductivity, ft/day

6.0 LIMITATIONS

6.1 Warranty

This report has been prepared for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

6.2 Auger and SPT Borings

The determination of soil type and conditions was performed from the ground surface to the maximum depth of the borings, only. Any changes in subsurface conditions that occur between or below the borings would not have been detected or reflected in this report.

Soil classifications that were made in the field are based upon identifiable textural changes, color changes, changes in composition or changes in resistance to penetration in the intervals from which the samples were collected. Abrupt changes in soil type, as reflected in boring logs and/or cross sections may not actually occur, but instead, be transitional.

Depth to the water table is based upon observations made during the performance of the auger and SPT borings. This depth is an estimate and does not reflect the annual variations that would be expected in this area due to fluctuations in rainfall and rates of evapotranspiration.

6.3 Site Figures

The measurements used for the preparation of the figures in this report were made using the provided site plan and by estimating distances from existing structures and site features. Figures in this report were not prepared by a licensed land surveyor and should not be interpreted as such.

6.4 Unanticipated Soil Conditions

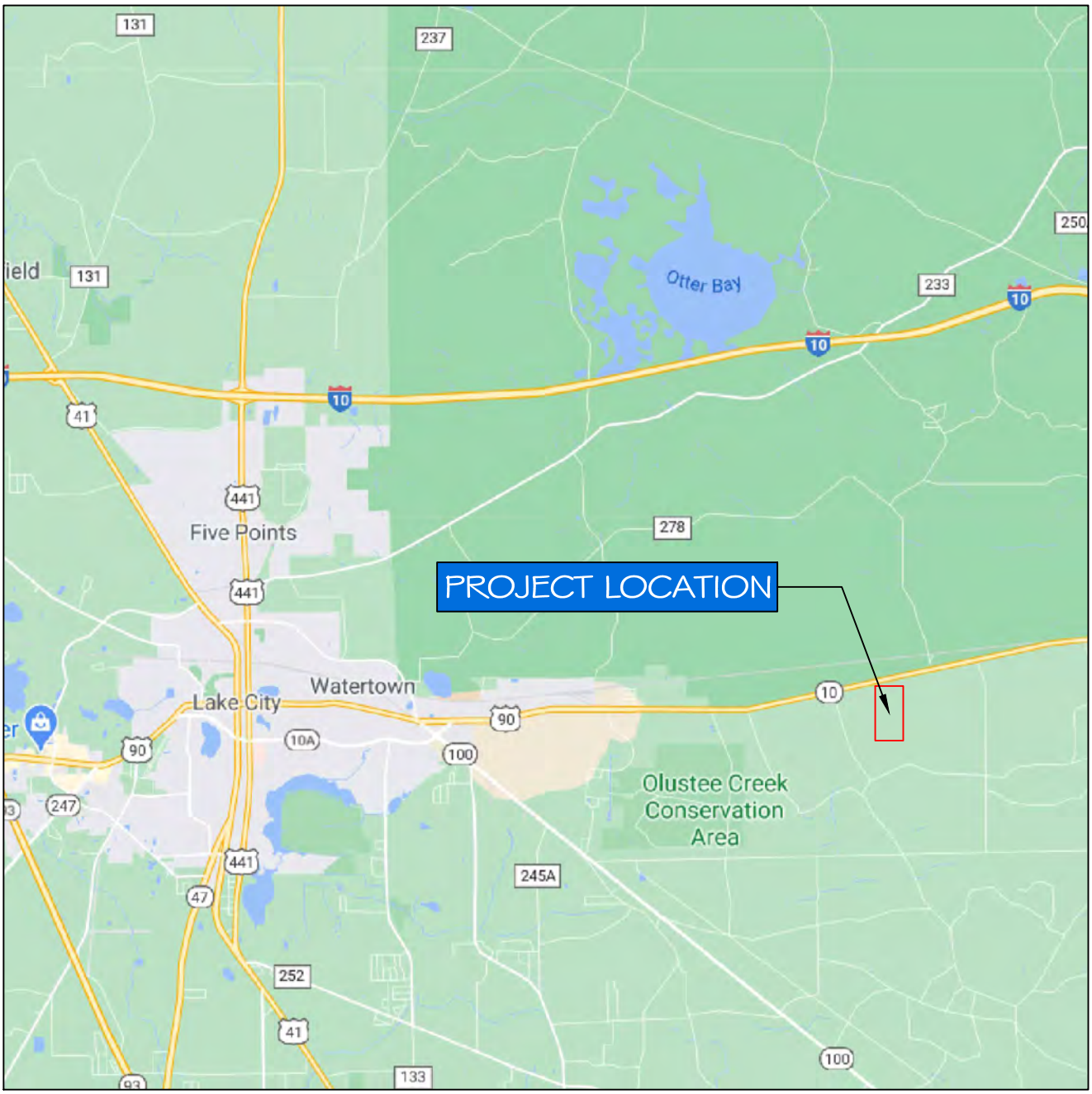
The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on Figure 2. This report does not reflect any variations that may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

6.5 Misinterpretation of Soil Engineering Report

GSE Engineering & Consulting, Inc. is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If others make the conclusions or recommendations based upon the data presented, those conclusions or recommendations are not the responsibility of GSE.

FIGURES



NORTH

NOT TO SCALE

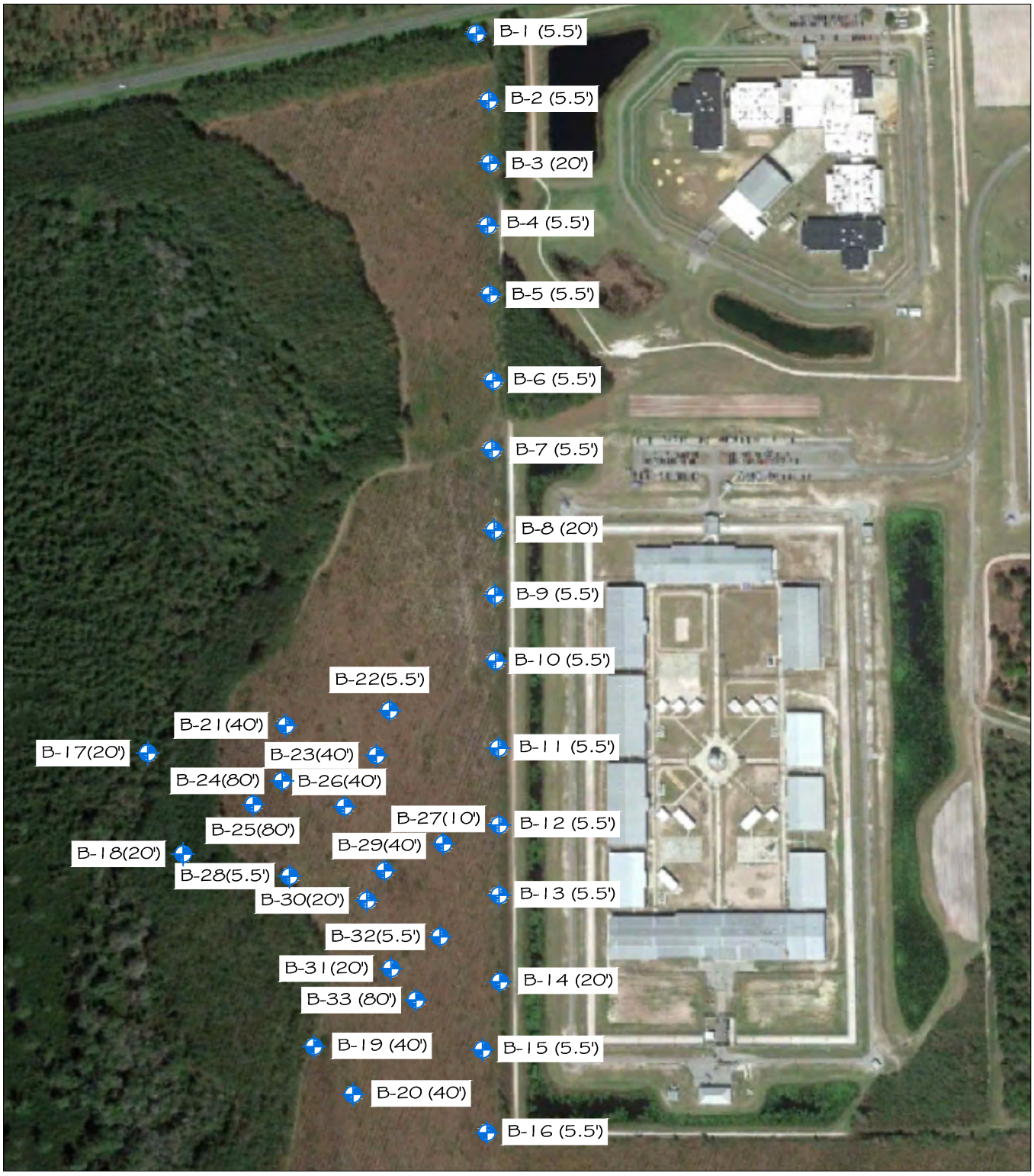
COLUMBIA COUNTY NF MIP
LAKE CITY, COLUMBIA COUNTY, FLORIDA
GSE PROJECT NO. 14987A

PROJECT SITE LOCATION MAP

DESIGNED BY: CRL
CHECKED BY : JEG
DRAWN BY : AXL

GSE Engineering & Consulting, Inc.

FIGURE 1



LEGEND:

SPT BORING

NORTH

SITE PLAN SHOWING APPROXIMATE LOCATIONS OF FIELD TESTS

COLUMBIA COUNTY NF MIP
LAKE CITY, COLUMBIA COUNTY, FLORIDA
GSE PROJECT NO. 14987A

DESIGNED BY: CRL
CHECKED BY : JEG
DRAWN BY : PJM

GSE Engineering & Consulting, Inc.

FIGURE 2

APPENDIX B

ENVIRONMENTAL RESOURCE PERMIT

SUWANNEE RIVER
WATER MANAGEMENT DISTRICT

November 29, 2021

David Kraus
Columbia County
PO Box 1529
Lake City, FL 32056-1529

SUBJECT: Permit Number ERP-023-212779-10
NFMIP Waste Water Treatment Plant

Dear David Kraus:

Enclosed is your ERP Individual Permit issued by the Suwannee River Water Management District on November 29, 2021. This permit is a legal document and should be kept with your other important documents. Permit issuance does not relieve you from the responsibility of obtaining any necessary permits from any federal, state, or local agencies for your project.

Noticing Your Permit:
For noticing instructions, please refer to the noticing materials in this package regarding closing the point of entry for someone to challenge the issuance of your permit. Please note that if a timely petition for administrative hearing is filed, your permit will become nonfinal and any activities that you choose to undertake pursuant to your permit will be at your own risk.

Compliance with Permit Conditions:
To submit your required permit compliance information, go to the District's website at https://permitting.sjrwmd.com/srepermitting/jsp/start.jsp. Click to sign-in to your existing account or to create a new account. Select the "Apply/Submit" tab, select "Submit Compliance Data", enter your permit number, and select "No Specific Date" for the Compliance Due Date Range. You will then be able to view all the compliance submittal requirements for your project. Select "the compliance item that you are ready to submit and then attach the appropriate information or form. The forms to comply with your permit conditions are available at floridaswater.com/permitting under the section "Handbooks, forms, fees, final orders". Click on forms to view all permit compliance forms, then scroll to the ERP application forms section and select the applicable compliance forms. Alternatively, if you have difficulty finding forms or need copies of the appropriate forms, please contact the Resource Management Division at (386) 362-1001.

Compliance with Other Permitting Programs:
This permit does not eliminate the necessity to obtain any required federal, state, local and special district authorizations prior to the start of any construction, alteration, operation, maintenance, removal or abandonment authorized by this permit.

The Suwannee River Water Management District did not issue a National Pollutant Discharge Elimination System (NPDES) permit for this project. If this project meets the thresholds such that a NPDES permit is required, you must apply to the Florida Department of Environmental Protection directly. More information about NPDES permits may be found online at

https://floridadep.gov/water/stormwater. **Failure to obtain a NPDES permit prior to construction could subject you to enforcement action by that agency.**

For projects which involve wetlands or surface waters, the Suwannee River Water Management District did not issue a federal authorization for use or impacts to wetlands under federal jurisdiction, this project. Therefore, you must apply directly to the US Army Corps of Engineers (USACE). More information about USACE permitting may be found online at https://www.saj.usace.army.mil/. **Failure to obtain USACE authorization prior to construction could subject you to federal enforcement action by that agency.**

Transferring Your Permit:

Your permit requires you to notify the District in writing within 30 days of any change in ownership or control of the project or activity covered by the permit, or within 30 days of any change in ownership or control of the real property on which the permitted project or activity is located or occurs. You will need to provide the District with the information specified in rule 62-330.340, Florida Administrative Code (F.A.C.). Generally, this will require you to complete and submit Form 62-330.340(1), "Request to Transfer Permit".

Please note that a permittee is liable for compliance with the permit before the permit is transferred. The District, therefore, recommends that you request a permit transfer in advance in accordance with the applicable rules. You are encouraged to contact District staff for assistance with this process.

Thank you and please let us know if you have additional questions. For general questions contact us at (386) 362-1001.

Sincerely,



Hugh Thomas
Executive Director

Enclosures: Permit

cc: District Permit File

SUWANNEE RIVER
WATER MANAGEMENT DISTRICT

ERP Individual Permit

PERMITTEE:
David Kraus
Columbia County
PO Box 1529
Lake City, FL 32056-1529

PERMIT NUMBER: ERP-023-212779-10
DATE ISSUED: November 29, 2021
DATE EXPIRES: November 29, 2026
COUNTY: Columbia
TRS: S33 T3S R18E

PROJECT: NFMIP Waste Water Treatment Plant

Upon completion, the approved entity to which operation and maintenance maybe transferred pursuant to rule 62-330.310 and 62-330.340 or 40B-4.1130, Florida Administrative Code (F.A.C) shall be:

Chad Williams
Columbia County
PO Box 1529
Lake City, FL 32056-1529

Based on the information provided to the Suwannee River Water Management District (District), the above mentioned project has met the conditions of issuance as found in subsection 62-330.301, subsections 62-330.407 through 62-330.635, or subsection 40B-4.3030, F.A.C. The permit is hereby in effect for the activity description below:

Previous permit was a conceptual approval of a surface water management system serving 1,451 acres of impervious surface, wetland mitigation sites, and impacts to 107.73 acres of wetlands and 10.76 acres of surface waters on a total project area of 2,622 acres. This permit authorizes the construction of 7.63 acres of impervious surfaces and the construction, operation, and maintenance of a stormwater management system serving the total 7.63 acres of impervious surfaces on a project area of 19.84 acres. The project shall be constructed in a manner consistent with the application package submitted by David Kraus, of Columbia County, and the plans and calculations certified by Richard Darabi, P.E., of Moore Bass Consulting, Inc., on or before October 29, 2021.

As the permittee and/or operation and maintenance entity, it is your responsibility to ensure that adverse off-site impacts do not occur either during or after the construction. Any additional construction or alterations not authorized by this permit may result in flood control or water quality problems both on and off site and will be a violation of District rule.

You and any other substantially affected persons are entitled to request an administrative hearing or mediation. Please refer to the enclosed notice of rights.

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under chapter 373, F.S.

2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the District staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.

3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007), and the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008), which are both incorporated by reference in paragraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.

4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice," (October 1, 2013), (http://www.flrules.org/Gateway/reference.asp?No=Ref-02505), incorporated by reference herein, indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C., and shall be submitted electronically or by mail to the Agency. However, for activities involving more than one acre of construction that also require a NPDES stormwater construction general permit, submittal of the Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities, DEP Form 62-621.300(4)(b), shall also serve as notice of commencement of construction under this chapter and, in such a case, submittal of Form 62-330.350(1) is not required.

5. Unless the permit is transferred under rule 62-330.340, F.A.C., or transferred to an operating entity under rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.

6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:

    a. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex — “Construction Completion and Inspection Certification for Activities Associated With a Private Single-Family Dwelling Unit” [Form 62-330.310(3)]; or

    b. For all other activities — “As-Built Certification and Request for Conversion to Operational Phase” [Form 62-330.310(1)].

    c. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.

7. If the final operation and maintenance entity is a third party:

    a. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.3 of Volume I) as filed with the Department of State, Division of Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

    b. Within 30 days of submittal of the as- built certification, the permittee shall submit “Request for Transfer of Environmental Resource Permit to the Perpetual Operation Entity” [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

8. The permittee shall notify the District in writing of changes required by any other regulatory District that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.

9. This permit does not:

    a. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in chapter 62-330, F.A.C.;

    b. Convey to the permittee or create in the permittee any interest in real property;

    c. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or

    d. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.

10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under chapters 253 and 258, F.S. Written authorization that requires formal execution by the

Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.

11. The permittee shall hold and save the District harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.

12. The permittee shall notify the District in writing:

    a. Immediately if any previously submitted information is discovered to be inaccurate; and

    b. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

13. Upon reasonable notice to the permittee, District staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.

14. If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, stone tools, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site area, the permitted project shall cease all activities involving subsurface disturbance in the vicinity of the discovery. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance Review Section (DHR), at (850)245-6333, as well as the appropriate permitting agency office. Project activities shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and the proper authorities notified in accordance with section 872.05, F.S. For project activities subject to prior consultation with the DHR and as an alternative to the above requirements, the permittee may follow procedures for unanticipated discoveries as set forth within a cultural resources assessment survey determined complete and sufficient by DHR and included as a specific permit condition herein.

15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under rule 62-330.201, F.A.C., provides otherwise.

16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under chapter 62-330, F.A.C., or cause violations of state water quality standards.

17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the District will require the

permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.

18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with section 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.

19. This permit does not authorize the permittee to cause any adverse impact to or “take” of state listed species and other regulated species of fish and wildlife. Compliance with state laws regulating the take of fish and wildlife is the responsibility of the owner or applicant associated with this project. Please refer to Chapter 68A-27 of the Florida Administrative Code for definitions of “take” and a list of fish and wildlife species. If listed species are observed onsite, FWC staff are available to provide decision support information or assist in obtaining the appropriate FWC permits. Most marine endangered and threatened species are statutorily protected and a “take” permit cannot be issued. Requests for further information or review can be sent to FWCConservationPlanningServices@MyFWC.com.

WITHIN 30 DAYS AFTER COMPLETION OF THE PROJECT, THE PERMITTEE SHALL NOTIFY THE DISTRICT, IN WRITING, THAT THE FACILITIES ARE COMPLETE.

AUTHORIZED BY: Suwannee River Water Management District

By: 

Hugh Thomas
Executive Director

NOTICE OF RIGHTS

1. A person whose substantial interests are or may be determined has the right to request an administrative hearing by filing a written petition with the Suwannee River Water Management District (District), or may choose to pursue mediation as an alternative remedy under Section 120.569 and 120.573, Florida Statutes, (F.S.), before the deadline for filing a petition. Choosing mediation will not adversely affect the right to a hearing if mediation does not result in a settlement. The procedures for pursuing mediation are set forth in Sections 120.569 and 120.57 F.S. Pursuant to Rule 28-106.111, Florida Administrative Code, (F.A.C.), the petition must be filed at the office of the District Clerk at District Headquarters, 9225 C.R. 49, Live Oak, Florida 32060 within twenty-one (21) days of receipt of written notice of the decision or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail actual notice). A petition must comply with Chapter 28-106, F.A.C.

2. If the Governing Board takes action which substantially differs from the notice of District decision to grant or deny the pe1mit application, a person whose substantial interests are or may be determined has the right to request an administrative hearing or may choose to pursue mediation as an alternative remedy as described above. Pursuant to Rule 28-106.111, F.A.C., the petition must be filed at the office of the District Clerk at District Headquarters, 9225 C.R. 49, Live Oak, Florida 32060 within twenty-one (21) days of receipt of written notice of the decision or within twenty-one (21) days of newspaper publication of the notice of District decision (for those persons to whom the District does not mail actual notice). Such a petition must comply with Chapter 28-106, F.A.C.

3. A substantially interested person has the right to a formal administrative hearing pursuant to Section 120.569 and 120.57(1), F.S., where there is a dispute between the District and the party regarding an issue of material fact. A petition for formal hearing must comply with the requirements set forth in Rule 28-106.201, F.A.C.

4. A substantially interested person has the right to an informal hearing pursuant to Section 120.569 and 120.57(2), F.S., where no material facts are in dispute. A petition for an informal hearing must comply with the requirements set forth in Rule 28-106.301, F.A.C.

5. A petition for an administrative hearing is deemed filed upon receipt of the petition by the Office of the District Clerk at the District Headquarters in Live Oak, Florida.

6. Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing pursuant to Rule 28-106.111, F.A.C.

7. The right to an administrative hearing and the relevant procedures to be followed is governed by Chapter 120, Florida Statutes, and Chapter 28-106, F.A.C.

8. Pursuant to Section 120.68, F.S., a person who is adversely affected by final District action may seek review of the action in the District Court of Appeal by filing a notice of appeal pursuant to the Florida Rules of Appellate Procedure, within 30 days of the rendering of the final District action.

9. A party to the proceeding before the District who claims that a District order is inconsistent with the provisions and purposes of Chapter 3 73, F. S., may seek review of the order pursuant to Section 373.114, F.S., by the Florida Land and Water Adjudicatory Commission, by filing a request for review with the Commission and serving a copy of the Department of Environmental

Protection and any person named in the order within 20 days of adoption of a rule or the rendering of the District order.

10. For appeals to the District Courts of Appeal, a District action is considered rendered after it is signed on behalf of the District, and is filed by the District Clerk.

11. Failure to observe the relevant time frames for filing a petition for judicial review, or for Commission review, will result in waiver of the right to review.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing Notice of Rights has been sent to:

David Kraus
Columbia County
PO Box 1529
Lake City, FL 32056-1529
(386) 758-1005

This November 29, 2021



_____
Deputy Clerk
Suwannee River Water Management District
9225 C.R. 49
Live Oak, Florida 32060
386.362.1001 or 800.226.1066 (Florida only)

cc: File Number: ERP-023-212779-10

NOTICING INFORMATION

Dear Permittee:

Please be advised that the Suwannee River Water Management District (District) has not published a notice in the newspaper advising the public that it has issued a permit for this project.

Newspaper publication, using the District's form, notifies members of the public of their right to challenge the issuance of the permit. If proper notice is given by newspaper publication, then there is a 21-day time limit to file a petition challenging the issuance of the permit.

To close the point of entry for filing a petition, you may publish (at your own expense) a onetime notice of the District's decision in a newspaper of general circulation within the affected area as defined in Section 50.011 of the Florida Statutes. If you do not publish a newspaper notice, the time to challenge the issuance of your permit will not expire.

A copy of the notice and a partial list of newspapers of general circulation are attached for your convenience. However, you are not limited to those listed newspapers. If you choose to close the point of entry and the notice is published, the newspaper will return to you an affidavit as proof of publication. In accordance with 40B-1.1010(4), F.A.C., a copy of the affidavit shall be provided to the District within 14 days of publication. A scanned copy of the affidavit may be forwarded to Tilda Musgrove by email at *tjm@srwmd.org* (preferred method) or send the original affidavit of publication to:

Tilda Musgrove
Resource Management
9225 CR 49
Live Oak, FL 32060

If you have any questions, please contact me at 386.362.1001.
Sincerely,

Tilda Musgrove

Tilda Musgrove
Business Resource Specialist
Resource Management

NOTICE OF AGENCY ACTION TAKEN BY THE
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

Notice is given that the following permit was issued on _____:
(Name and address of applicant)_____
permit#_____. The project is located in _____County, Section _____, Township _____ South, Range _____ East. The permit authorizes a surface water management system on _____ acres for _____ known as _____. The receiving water body is _____.
A person whose substantial interests are or may be affected has the right to request an administrative hearing by filing a written petition with the Suwannee River Water Management District (District). Pursuant to Chapter 28-106 and Rule 40BB-1.1010, Florida Administrative Code (F.A.C.), the petition must be filed (received) either by delivery at the office of the Resource Management Business Resource Specialist at District Headquarters, 9225 CR 49, Live Oak FL 32060 or by e-mail to tjm@srwmd.org, within twenty-one (21) days of newspaper publication of the notice of intended District decision (for those persons to whom the District does not mail or email actual notice). A petition must comply with Sections 120.54(5)(b)4. and 120.569(2)(c), Florida Statutes (F.S.), and Chapter 28106, F.A.C. The District will not accept a petition sent by facsimile (fax). Mediation pursuant to Section 120.573, F.S., is not available.

A petition for an administrative hearing is deemed filed upon receipt of the complete petition by the District Clerk at the District Headquarters in Live Oak, FL during the District's regular business hours. The District's regular business hours are 8 a.m. – 5 p.m., excluding weekends and District holidays. Petitions received by the District Clerk after the District's regular business hours shall be deemed filed as of 8 a.m. on the next regular District business day.

The right to an administrative hearing and the relevant procedures to be followed are governed by Chapter 120, Florida Statutes, Chapter 28-106, Florida Administrative Code, and Rule 40B-1.1010, Florida Administrative Code. Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means the District's final action may be different from the position taken by it in this notice. **Failure to file a petition for an administrative hearing within the requisite time frame shall constitute a waiver of the right to an administrative hearing. (Rule 28-106.111, F.A.C.).**

If you wish to do so, you may request the Notice of Rights for this permit by contacting the Business Resource Specialist in the Division of Resource Management (RM), 9225 CR 49, Live Oak, FL 32060, or by phone at 386.362.1001.

NEWSPAPER ADVERTISING

ALACHUA
Gainesville Sun Legal Advertising
PO Box 14747
Gainesville, FL 32614
352.372.4222

BRADFORD
Bradford County Telegraph, Legal Advertising
P. O. Drawer A
Starke, FL 32901
904-964-6305/ fax 904-964-8628

COLUMBIA
Lake City Reporter
180 E Duval Street
Lake City, FL 32055
386.754.0401

DIXIE
Dixie County Advocate
174 County Road 351
Cross City, FL 32628
352.498.3312

GILCHRIST
Gilchrist County Journal
207 N Main St
Trenton, FL 32693
352.463.7135

HAMILTON
Jasper News
521 Demorest Street SE
Live Oak, FL 32064
386.362.1734

JEFFERSON
Monticello News
PO Drawer 772
Madison, FL 32344
850.997.3568

LAFAYETTE
Mayo Free Press
521 Demorest Street SE
Live Oak, FL 32064
386.362.1734

LEVY
Levy County Journal
PO Box 159
Bronson, FL 32621
352.486.2312

MADISON
Madison Carrier
PO Drawer 772
Madison, FL 32344
850.973.4141

SUWANNEE
Suwannee Democrat
521 Demorest Street SE
Live Oak, FL 32064
386.364.1734

TAYLOR
Taco Times
PO Box 888
Perry, FL 32348
850.584.5513

UNION
Union County Times
125 E Main Street
Lake Butler, FL 32054
386.496.2261

APPENDIX C

NOTICE OF ISSUANCE FDEP WWTF PERMIT

FLORIDA DEPARTMENT OF Environmental Protection

Northeast District Office
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256-7577

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Shawn Hamilton
Secretary

February 21, 2022

In the Matter of an
Application for Permit by:

Columbia County Board Commissioners
Mr. David Kraus
County Manager
P O Box 1529
Lake City, Florida 32056-1529
Phone: (386) 758 – 2182
Email: David_Kraus@columbiacountyfla.com

File Number FLAB07233-001-DW1P
Columbia County
North Florida Mega Industrial Park WWTF

NOTICE OF PERMIT ISSUANCE

Enclosed is Permit Number FLAB07233 to construct and operate the North Florida Mega Industrial Park WWTF, which is a new 0.510-MGD annual average daily flow domestic wastewater treatment facility (WWTF). The final treated effluent/reclaimed water would be land applied via a slow-rate restricted public access system. The wastewater treatment facility will serve the North Florida Mega Industrial Park service area. The facility will be located at latitude 30° 11' 13.65" N, longitude 82° 30' 41.19" W, on 153 Southeast Tyre Road, Lake City, Florida 32025 in Columbia County.

Monitoring requirements under this permit are effective upon completion and placing into service of the new facility. Until such time, the permittee shall submit reports in accordance with effective permit requirements, if any.

NOTICE OF RIGHTS

Judicial Review

Upon issuance of this final permit, any party to this order has the right to seek judicial review of it under Section 120.68, F.S., by the filing of a notice of appeal under Florida Rules of Appellate Procedure 9.110 and 9.190 with the Clerk of the Department of Environmental Protection in the Office of General Counsel (Mail Station #35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000) and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice must be filed within 30 days after this order is filed with the Clerk of the Department.

EXECUTION AND CLERKING
Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Thomas G. Kallemeyn
Permitting Program Administrator

Attachment(s):
1. Permit No. FLAB07233
2. Statement of Basis
3. DMR

CERTIFICATE OF SERVICE
The undersigned duly designated deputy clerk hereby certifies that this document and all attachments were sent on the filing date below to the following listed persons:

Thomas W. Friedrich, PE, Jones Edmunds, tfriedrich@jonesedmunds.com
Jamie Sortevik Bell, PE, Jones Edmunds, jsbell@jonesedmunds.com
Chad Williams, P.E., County Engineer, chad_williams@columbiacountyfla.com
Columbia County Boards of Commissioners, bccadmin@columbiacountyfla.com
ron_williams@columbiacountyfla.com, rhollingsworth@columbiacountyfla.com,
tmurphy@columbiacountyfla.com, twitt@columbiacountyfla.com
Marc Minno, marc.minno@srwmd.org, SRWMD
Marc Harris, P.E., FDEP/ Tallahassee
John Davis, P.G., FDEP/NED
Thomas Kallemeyn, FDEP-NED
D. A. Vo, P.E., DEP/NED

FILING AND ACKNOWLEDGMENT
FILED, on February 21, 2022, pursuant to Section 120.52, F. S., with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk

February 21, 2022
Date

FLORIDA DEPARTMENT OF Environmental Protection

Northeast District Office
8800 Baymeadows Way West, Suite 100
Jacksonville, Florida 32256-7577

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Shawn Hamilton
Secretary

STATE OF FLORIDA
DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:

Columbia County Board Commissioners

RESPONSIBLE OFFICIAL:
Mr. David Kraus
County Manager
P O Box 1529
Lake City, Florida 32056-1529
Phone: (386) 758 – 2182
Email: David_Kraus@columbiacountyfla.com

PERMIT NUMBER: FLAB07233
FILE NUMBER: FLAB07233 – DW1P
ISSUANCE DATE: February 21, 2022 (001/NP)
EFFECTIVE DATE: February 21, 2022
EXPIRATION DATE: February 20, 2027

FACILITY:
North Florida Mega Industrial Park (NFMIP) WWTF
153 Southeast Tyre Road
Lake City, FL 32025
Columbia County
Latitude: 30° 11' 13.65" N Longitude: -82° 30' 41.19" W

This permit is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and applicable rules of the Florida Administrative Code (F.A.C.). This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above-named permittee is hereby authorized to construct and operate the facilities in accordance with the documents attached hereto and specifically described as follows:

WASTEWATER TREATMENT:

Phase I
The NFMIP WWTP will include construction of a 0.500 MGD AADF, 4-Stage Bardenpho package wastewater treatment plant which includes headworks, equalization tanks, waste sludge aerobic digesters and associated pumps, blowers, and appurtenances. The package plant will meet the Santa Fe BMAP requirements to produce a reclaimed water with a Total-Nitrogen (TN) of less than or equal to 3.0 mg/L-TN on an Average Annual Basis. The reclaimed water will be land applied on a 162-acre restricted access spray field. The sprayfield is on land owned by Weyerhauser and provided to the County for the economic development and job creation within the NFMIP. The associated WWTP that is owned by the county will serve NFMIP customers. Weyerhauser is providing the existing silviculture land for the NFMIP WWTP effluent spray field to the County for an interim period (5 to 10-years) to serve the Phase I WWTP.

Phase I WWTP will include the following:

- A master influent pump station designed for Phase 1 peak-hour flow (PHF) of 1.5 MGD, and future PHF of 4.5 MGD.
- An influent headworks structure consisting of two-mechanical drum screens of 1.5 MGD peak hour flow capacity and a manual bypass screen.

- A 1,365,000 million-gallon (MG) volume package plant with equalization and configured as a 4-Stage Bardenpho unit treatment process. The package plant consists of the following: (two- 211,000 gallon equalization tanks for a total volume of 422,000 gallons; two-74,000 gallon Stage 1 anoxic zones for a total volume of 148,000 gallons; an internal recycle (nitrate recycle) pump station of 3.0 MGD (Anoxic Recycle Ratio of 300 to 600% of influent Q); two-187,000 gallon aeration zones with fine bubble diffusers and PD Blowers for a total volume of 374,000 gallon; two-35,500 gallon 2nd Anoxic Basins and two-5,000 gallon re-aeration basins for a total of 81,000 gallons. Two secondary clarifiers of 89,000 gallons/each and 881 square feet/each of surface area for a total volume of 178,000 gallons and two aerobic digesters of 81,000 gallons/each for a total volume of 162,000 gallons.
- Addition of supplemental carbon feed system to optimize the Total-Nitrogen removal capabilities for the 4-Stage BNR WWTP.
- A cast-in place chlorine contact tank (CCT) split in two chambers, each of 75,000 gallons for a total volume of 150,000 gallons; disinfection is achieved by a chemical feed system using sodium hypochlorite.
- A clearwell at the end of the CCT contains two 700 gpm reclaim water transfer pumps and is connected to a lined 1.5 MG reclaim water storage pond to allow 3-days storage at design AADF.

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The package plant will be operated to provide advanced secondary treatment and basic level disinfection.

Biosolids will be aerobically digested, decant thickened, and hauled by truck to a Residuals Management Facility (RMF) or be Land Applied by Contract Hauler to a FDEP permitted site.

An FDEP UIC Permit Application for a UIC Class 5 exploratory well and monitoring wells was submitted for construction of an exploratory well for a Class I Municipal Deep Injection Well to provide 100% backup disposal of excess reclaim water for the WWTP.

Phase II – Public Access Reclaim Water Improvements– NFMIP WWTP.
Phase II improvements include the addition of effluent filters to provide high-level disinfection for unrestricted public access reuse water, associated storage and reclaim water high service pumping, and construction of a Class I DIW to provide 100% backup disposal. Construction of modifications to the 0.500 MGD, AADF, Category I, Class C, package wastewater treatment plant to provide effluent disk filters to produce high-level disinfected reclaim water for unrestricted public access reuse to the customers in the NFMIP and use the 162-acre restricted access sprayfield for excess reuse water disposal. Phase II to be permitted later.

Phase III – North Florida Mega Industrial Park (NFMIP) WWTP Expansion to 1.5 MGD AADF.
The Phase III WWTP includes an expansion to 1.5 MGD AADF with the addition of new headworks with mechanical screening and grit removal, two 4-Stage Bardenpho Treatment Tanks, two- Final Clarifiers and operation of the 2-MGD DIW as 100% backup to the public access reclaim water system Phase III to be permitted later.

REUSE OR DISPOSAL:

Land Application R-001: A new 0.500 MGD annual average daily flow permitted capacity slow-rate restricted public access system, R-001 which consists of west and east segments that collectively comprise approximately 162 acres as detailed below:

- West Segment 1: 99 acres for irrigation of reclaimed water. Segment 1 will be constructed first and provide disposal of 0.290 MGD of reclaimed water.

- East Segment 2: 63 acres for irrigation of reclaimed water will be constructed as additional customers are connected and provide disposal of 0.210 MGD of reclaimed water for a total disposal capacity of 0.500 MGD

Leachate from Columbia County Winfield Class I MSW Landfill is off-loaded to on-site storage tanks, pumped and metered at a low rate into the WWTF influent pump station where it combines with the domestic wastewater for treatment. Monitoring site INF-1 will monitor influent quality.

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in this cover sheet and Part I through Part IX on pages 1 through 24 of this permit.

I. RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

A. Reuse and Land Application Systems

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse System R-001. Such reclaimed water shall be limited and monitored by the permittee as specified below and reported in accordance with Permit Condition I.B.7.:

			Limitations		Monitoring Requirements			
Parameter	**Units**	**Max/ Min**	**Limit**	**Statistical Basis**	**Frequency of Analysis**	**Sample Type**	**Monitoring Site Number**	**Notes**
Flow	MGD	Max	0.500	Annual Average	5 Days/Week	Recording Flow Meter with Totalizer	EFA-1	See I.A.3
		Max	Report	Monthly Average				
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	Weekly	8-hr FPC	EFA-1	
		Max	30.0	Monthly Average				
		Max	45.0	Weekly Average				
		Max	60.0	Single Sample				
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	Weekly	8-hr FPC	EFA-1	
		Max	30.0	Monthly Average				
		Max	45.0	Weekly Average				
		Max	60.0	Single Sample				
Coliform, Fecal	#/100 mL	Max	200	Annual Average	Weekly	Grab	EFA-1	See I.A.4 & I.A.5
		Max	200	Monthly Geometric Mean				
		Max	400	90th Percentile				
		Max	800	Single Sample				
pH	s.u.	Min	6.0	Single Sample	5 Days/Week	Grab	EFA-1	
		Max	8.5	Single Sample				

			Limitations		Monitoring Requirements			
Parameter	**Units**	**Max/ Min**	**Limit**	**Statistical Basis**	**Frequency of Analysis**	**Sample Type**	**Monitoring Site Number**	**Notes**
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	5 Days/Week	Grab	EFA-1	See I.A.6
Nitrogen, Total	mg/L	Max	3.0	Annual Average	Bi-weekly; every 2 weeks	8-hr FPC	EFA-1	
		Max	Report	Monthly Average				
		Max	Report	Single Sample				
Phosphorus, Total (as P)	mg/L	Max	Report	Annual Average	Bi-weekly; every 2 weeks	8-hr FPC	EFA-1	
		Max	Report	Monthly Average				
		Max	Report	Single Sample				
Nitrite plus Nitrate, Total 1 det. (as N)	mg/L	Max	Report	Single Sample	Bi-weekly; every 2 weeks	8-hr FPC	EFA-1	
Primary Drinking Water Standards (Reclaimed Water)	mg/L	Max	Report	Single Sample	Annually	24-hour flow proportioned composite	RWS-A	See I.B.8
Secondary Drinking Water Standards (Reclaimed Water)	mg/L	Max	Report	Single Sample	Annually	24-hour flow proportioned composite	RWS-A	See I.B.8

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I.A.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
EFA-1	Sample immediately after disinfection before discharge
RWS-A	Sample point (same as EFA-1) for Primary and Secondary drinking water standards.

3. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-600.200(25)]*

4. The effluent limitation for the monthly geometric mean for fecal coliform is only applicable if 10 or more values are reported. If fewer than 10 values are reported, the monthly geometric mean shall be calculated and reported on the Discharge Monitoring Report to be used to calculate the annual average. All other fecal coliform effluent limitations included in permit condition I.A.1 apply regardless of the number of values reported. *[62-600.440(5)(b)]*

5. To report the "90th percentile,"
   a. Place the bacteria results in ascending order (from lowest to highest value) and assign each sample a number, 1 for the lowest value.
   b. Multiply the total number of samples by 0.9 to determine the 90th percentile level.
   c. Report the value of the sample that corresponds to the 90th percentile level (e.g., 10 samples x 0.9 = 9, report the value of the 9th sample). If the 90th percentile level is not a whole number, rounding or interpolation should be used to determine the 90th percentile. When rounding, round down to the nearest whole number if the decimal is 0.4 or lower, and round up to the nearest whole number if the decimal is 0.5 or higher (e.g., 12 samples x 0.9 = 10.8, report the value of the 11th sample if rounding).

   [62-600.440(5)(a)3]

6. Total residual chlorine must be maintained for a minimum contact time of 15 minutes based on peak hourly flow. *[62-610.410][62-600.440(5)(c) and (6)(b)]*

B. Other Limitations and Monitoring and Reporting Requirements

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the treatment facility shall be limited and monitored by the permittee as specified below and reported in accordance with condition I.B.7.:

			Limitations		Monitoring Requirements			
Parameter	**Units**	**Max. /Min**	**Limit**	**Statistical Basis**	**Frequency of Analysis**	**Sample Type**	**Monitoring Site Number**	**Notes**
Flow	MGD	Max	0.500	Annual Average	5 Days/Week	Recording Flow Meter with Totalizer	INF-1	See I.B.4
		Max	Report	Monthly Average				
		Max	Report	3-Month Rolling Average				
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	Monthly Average	Monthly	Calculated	CAL-1	
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	Weekly	8-hr FPC	INF-1	See I.B.3

			Limitations		Monitoring Requirements			
Parameter	**Units**	**Max. /Min**	**Limit**	**Statistical Basis**	**Frequency of Analysis**	**Sample Type**	**Monitoring Site Number**	**Notes**
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	Weekly	8-hr FPC	INF-1	See I.B.3

2. Samples shall be taken at the monitoring site locations listed in Permit Condition I.B.1. and as described below:

Monitoring Site Number	Description of Monitoring Site
INF-1	Sample prior to any treatment and prior to any recycled flow
CAL-1	Calculation of percent capacity of the three-month average daily flow through the WWTF.

3. Influent samples shall be collected so that they do not contain digester supernatant or return activated sludge, or any other plant process recycled waters. *[62-600.660(4)(a)]*

4. A recording flow meter with totalizer shall be utilized to measure flow and calibrated at least once every 12 months. *[62-600.200(25)]*

5. The sample collection, analytical test methods, and method detection limits (MDLs) applicable to this permit shall be conducted using a sufficiently sensitive method to ensure compliance with applicable water quality standards and effluent limitations and shall be in accordance with Rule 62-4.246, Chapters 62-160 and 62-600, F.A.C., and 40 CFR 136, as appropriate. The list of Department established analytical methods, and corresponding MDLs (method detection limits) and PQLs (practical quantitation limits), which is titled "FAC 62-4 MDL/PQL Table (November 10, 2020)" is available at https://floridadep.gov/dear/quality-assurance/content/quality-assurance-resources. The MDLs and PQLs as described in this list shall constitute the minimum acceptable MDL/PQL values and the Department shall not accept results for which the laboratory's MDLs or PQLs are greater than those described above unless alternate MDLs and/or PQLs have been specifically approved by the Department for this permit. Any method included in the list may be used for reporting as long as it meets the following requirements:

   a. The laboratory's reported MDL and PQL values for the particular method must be equal or less than the corresponding method values specified in the Department's approved MDL and PQL list;

   b. The laboratory reported MDL for the specific parameter is less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Parameters that are listed as "report only" in the permit shall use methods that provide an MDL, which is equal to or less than the applicable water quality criteria stated in 62-302, F.A.C.; and

   c. If the MDLs for all methods available in the approved list are above the stated permit limit or applicable water quality criteria for that parameter, then the method with the lowest stated MDL shall be used.

When the analytical results are below method detection or practical quantitation limits, the permittee shall report the actual laboratory MDL and/or PQL values for the analyses that were performed following the instructions on the applicable discharge monitoring report.

Where necessary, the permittee may request approval of alternate methods or for alternative MDLs or PQLs for any approved analytical method. Approval of alternate laboratory MDLs or PQLs are not necessary if the laboratory reported MDLs and PQLs are less than or equal to the permit limit or the applicable water quality criteria, if any, stated in Chapter 62-302, F.A.C. Approval of an analytical method not included in the above-referenced list is not necessary if the analytical method is approved in accordance with 40 CFR 136 or deemed acceptable by the Department. *[62-4.246, 62-160]*

6. The permittee shall provide safe access points for obtaining representative samples which are required by this permit. *[62-600.650(2)]*

7. Monitoring requirements under this permit are effective on the first day of the second month following the effective date of the permit. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e. monthly, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Unless specified otherwise in this permit, monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below. DMRs shall be submitted for each required monitoring period including periods of no discharge.

REPORT Type on DMR	Monitoring Period	Submit by
Monthly	first day of month - last day of month	28th day of following month
Once Every Two Months	January 1 - February 28/29 March 1 - April 30 May 1 - June 30 July 1 - August 31 September 1 - October 31 November 1 - December 31	March 28 May 28 July 28 September 28 November 28 January 28
Quarterly	January 1 - March 31 April 1 - June 30 July 1 - September 30 October 1 - December 31	April 28 July 28 October 28 January 28
Semiannual	January 1 - June 30 July 1 - December 31	July 28 January 28
Annual	January 1 - December 31	January 28

The permittee may submit either paper or electronic DMR forms. If submitting electronic DMR forms, the permittee shall use the electronic DMR system approved by the Department (EzDMR) and shall electronically submit the completed DMR forms using the DEP Business Portal at https://www.fldepportal.com/go/. Reports shall be submitted to the Department by the twenty-eighth (28th) of the month following the month of operation. Data submitted in electronic format is equivalent to data submitted on signed and certified paper DMR forms.

If submitting paper DMR forms, the permittee shall make copies of the attached DMR forms, without

altering the original format or content unless approved by the Department, and shall mail the completed DMR forms to the Department's Northeast District Office at the address specified in Permit Condition I.B.10. by the twenty-eighth (28th) of the month following the month of operation.

[62-620.610(18)][62-600.680(1)]

8. During the period of operation authorized by this permit, reclaimed water or effluent shall be monitored annually for the primary and secondary drinking water standards contained in Chapter 62-550, F.A.C., (except for asbestos, total coliform, color, odor, and residual disinfectants). These monitoring results shall be reported to the Department annually on the DMR. During years when a permit is not renewed, a certification stating that no new non-domestic wastewater dischargers have been added to the collection system since the last reclaimed water or effluent analysis was conducted may be submitted with the signed DMR in lieu of performing the analysis. When such a certification is submitted with the DMR, monitoring not required this period should be noted on the DMR. The annual reclaimed water or effluent analysis report, and certification if applicable, shall be completed and submitted in a timely manner so as to be received by the Department at the address identified on the DMR by January 28 of each year. Approved analytical methods identified in Rule 62-620.100(3)(j), F.A.C., shall be used for the analysis. If no method is included for a parameter, methods specified in Chapter 62-550, F.A.C., shall be used. *[62-600.660(2) and (3)(d)][62-600.680(2)][62-610.300(4)]*

9. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. *[62-610.870(3)]*

10. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24-hour notifications, shall be submitted to or reported to, as appropriate, the Department's Northeast District Office at the address specified below:

    Florida Department of Environmental Protection
    Northeast District
    8800 Baymeadows Way West
    Suite 100
    Jacksonville, Florida 32256-7577

    Phone Number - (904) 256-1700
    FAX Number - (904) 256-1588
    (All FAX copies and e-mails shall be followed by original copies.)

    [62-620.305]

11. All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. *[62-620.305]*

II. BIOSOLIDS MANAGEMENT REQUIREMENTS

A. Basic Requirements

1. Biosolids generated by this facility may be transferred to City of Lake City or disposed of in a Class I solid waste landfill. Transferring biosolids to an alternative biosolids treatment facility does not require a permit modification. However, use of an alternative biosolids treatment facility requires

submittal of a copy of the agreement pursuant to Rule 62-640.880(1)(c), F.A.C., along with a written notification to the Department at least 30 days before transport of the biosolids. *[62-620.320(6), 62-640.880(1)]*

2. The permittee shall monitor and keep records of the quantities of biosolids generated, received from source facilities, treated, distributed and marketed, land applied, used as a biofuel or for bioenergy, transferred to another facility, or landfilled. These records shall be kept for a minimum of five years. *[62-640.650(4)(a)]*

3. Biosolids quantities shall be monitored by the permittee as specified below. Results shall be reported on the permittee's Discharge Monitoring Report for Monitoring Group RMP-Q in accordance with Condition I.B.7.

			Biosolids Limitation		Monitoring Requirements			
Parameter	Units	Max. /Min	Limit	Statistical Basis	Frequency of Analysis	Sample Type	Monitoring Site Number	Notes
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-1	
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	Monthly	Calculated	RMP-2	

[62-640.650(5)(a)1]

4. Biosolids quantities shall be calculated as listed in Permit Condition II.3 and as described below:

Monitoring Site Number	Description of Monitoring Site Calculations
RMP-1	Calculated amount of biosolids landfilled
RMP-2	Calculated amount of biosolids transferred

5. The treatment, management, transportation, use, land application, or disposal of biosolids shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. *[62-640.400(6)]*

6. Storage of biosolids or other solids at this facility shall be in accordance with the Facility Biosolids Storage Plan. *[62-640.300(4)]*

7. Biosolids shall not be spilled from or tracked off the treatment facility site by the hauling vehicle. *[62-640.400(9)]*

B. Disposal

1. Disposal of biosolids, septage, and "other solids" in a solid waste disposal facility, or disposal by placement on land for purposes other than soil conditioning or fertilization, such as at a monofill, surface impoundment, waste pile, or dedicated site, shall be in accordance with Chapter 62-701, F.A.C. *[62-640.100(6)(b) & (c)]*

C. Transfer

1. The permittee shall not be held responsible for treatment and management violations that occur after its biosolids have been accepted by a permitted biosolids treatment facility with which the source facility has an agreement in accordance with subsection 62-640.880(1)(c), F.A.C., for further treatment, management, or disposal. *[62-640.880(1)(b)]*

2. The permittee shall keep hauling records to track the transport of biosolids between the facilities. The hauling records shall contain the following information:

Source Facility
1. Date and time shipped
2. Amount of biosolids shipped
3. Degree of treatment (if applicable)
4. Name and ID Number of treatment facility
5. Signature of responsible party at source facility
6. Signature of hauler and name of hauling firm

Biosolids Treatment Facility or Treatment Facility
1. Date and time received
2. Amount of biosolids received
3. Name and ID number of source facility
4. Signature of hauler
5. Signature of responsible party at treatment facility

A copy of the source facility hauling records for each shipment shall be provided upon delivery of the biosolids to the biosolids treatment facility or treatment facility. The treatment facility permittee shall report to the Department within 24 hours of discovery any discrepancy in the quantity of biosolids leaving the source facility and arriving at the biosolids treatment facility or treatment facility.

[62-640.880(4)]

D. Receipt

1. If the permittee intends to accept biosolids from other facilities, a permit revision is required pursuant to paragraph 62-640.880(2)(d), F.A.C. *[62-640.880(2)(d)]*

III. GROUNDWATER REQUIREMENTS

A. Construction Requirements

1. The permittee shall give at least 72-hours' notice to the Department's Northeast District Office, prior to the installation of any monitoring wells. *[62-520.600(6)(h)]*

2. Before construction of new groundwater monitoring wells, a soil boring shall be made at each new monitoring well location to properly determine monitoring well specifications such as well depth, screen interval, screen slot, and filter pack. *[62-520.600(6)(g)]*

3. Within 30 days after installation of a monitoring well, the permittee shall submit to the Department's Northeast District Office well completion reports and soil boring/lithologic logs on the DEP Form 62-520.900(3), Monitoring Well Completion Report. *[62-520.600(6)(j) and .900(3)]*

4. All piezometers and monitoring wells not part of the approved groundwater monitoring plan shall be plugged and abandoned in accordance with Rule 62-532.500(5), F.A.C., unless future use is intended. *[62-532.500(5)]*

5. Permittee shall, prior to initial application of reclaimed water, install the monitoring wells identified in Permit Condition III.B.5. *[62-520.600(5)(a)(1)]*

6. Permittee shall, prior to initial application of reclaimed water, sample all monitoring well for the primary and secondary drinking water parameters listed in Tables 1, 4 and 6 of Chapter 62-550 (*excluding asbestos, color and odor*), pursuant to 62-520.600(5)(a)(2). *NOTE: Laboratory report is acceptable for submittal – no transcription to other reporting format is required. [62-520.600(5)(b)]*

B. Operational Requirements

1. For the Part II land application system(s), all groundwater quality criteria specified in Chapter 62-520, F.A.C., shall be met at the edge of the zone of discharge. The zone of discharge for Land Application Site R-001 shall extend horizontally 100 feet from the application site or to the facility's property line if less, and vertically to the base of the shallow water table aquifer. *[62-520.200(27)] [62-520.465]*

2. The groundwater minimum criteria specified in Rule 62-520.400 F.A.C., shall be met within the zone of discharge. *[62-520.400 and 62-520.420(4)]*

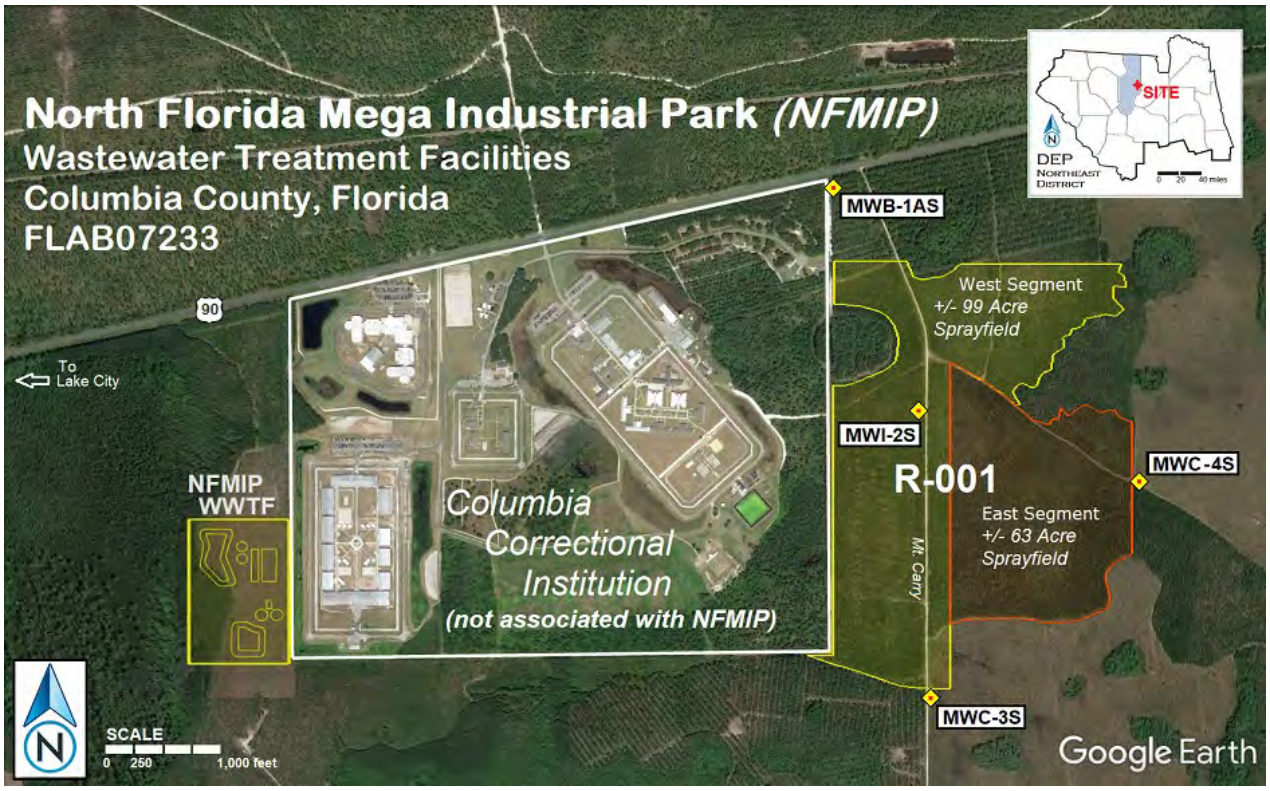
3. If the concentration for any monitored constituent in the natural background quality of the groundwater is greater than the stated maximum, or in the case of pH is also less than the minimum, the representative background quality shall be the prevailing standard. *[62-520.420(2)]*

4. The groundwater minimum criteria specified in Rule 62-520.400 F.A.C., shall be met at the point of discharge. *[62-520.400 and 62-520.430]*

5. Upon placing the R-001 in operation, the permittee shall begin sampling groundwater at the new monitoring wells identified below in accordance with this permit and the approved groundwater monitoring plan. *[62-520.600] [62-610.412]*

Monitoring Well ID	**Alternate Well Name and/or Monitoring Location**	**Latitude** (North)	**Longitude** (West)	**Depth** (Feet)	**Aquifer Monitored**	**New or Existing**
MWB-1AS	West of sprayfield road entrance	±30°11'47"	±82°29'43"	±15	Surficial	New
MWI-2S*	Mt Carry road; central area of west segment (99-acre) sprayfield	±30°11'27"	±82°29'34"	±15	Surficial	New
MWC-3S	Mt. Carry road; southern limit of west segment (99-acre) sprayfield	±30°11'03"	±82°29'33"	±15	Surficial	New
MWC-4S	Eastern margin of east segment (63-acre) sprayfield	±30°11'21"	±82°29'12"	±15	Surficial	New

MWC = Compliance; MWB = Background; MWI = Intermediate **See Permit Conditions III.A.6 and III.B.12*



6. The following parameters shall be analyzed for each monitoring well identified in Permit Condition III. B.7. Parameters may be added or deleted on a case by case basis in accordance with subsection 62-600.650(3), F.A.C.):

Parameter	Compliance Well Limit	Units	Sample Type	Monitoring Frequency
Water Level Relative to NGVD	Report	ft	In-situ	Quarterly
Nitrite+Nitrate, Total (as N)	10	mg/L	Grab	Quarterly
Solids, Total Dissolved (TDS)	500	mg/L	Grab	Quarterly
Arsenic, Total Recoverable	10	ug/L	Grab	Quarterly
Chloride (as Cl)	250	mg/L	Grab	Quarterly
Cadmium, Total Recoverable	5	ug/L	Grab	Quarterly
Chromium, Total Recoverable	100	ug/L	Grab	Quarterly
Lead, Total Recoverable	15	ug/L	Grab	Quarterly
Coliform, Fecal	4	#/100mL	Grab	Quarterly
pH	6.5-8.5	s.u.	In-situ	Quarterly
Sulfate, Total	250	mg/L	Grab	Quarterly
Turbidity	Report	NTU	Grab	Quarterly

[62-520.600(11)(b)] [62-600.670] [62-600.650(3)] [62-520.310(5)]

7. Water levels shall be recorded before evacuating each well for sample collection. Elevation references shall include the top of the well casing and land surface at each well site (NAVD allowable) at a precision of plus or minus 0.01 foot. *[62-520.600(11)(c)] [62-610.412(2)(c), 62-610.463(3)(a), 62-610.510(3)(b), 62-610.568(8), 62-610.613(3))]*

8. Groundwater monitoring wells shall be purged prior to sampling to obtain representative samples. *[62-160.210] [62-600.670(3)]*

9. Analyses shall be conducted on unfiltered samples, unless filtered samples have been approved by the Department's Northeast District Office as being more representative of groundwater conditions. *[62-520.310(5)]*

10. Groundwater monitoring test results shall be submitted on Part D of Form 62-620.910(10) in accordance with Permit Condition I. B.7. *[62-520.600(11)(b)] [62-600.670][62-600.680(1)] [62-620.610(18)]*

11. If any monitoring well becomes inoperable or damaged to the extent that sampling or well integrity may be affected, the permittee shall notify the Department's Northeast District Office within two business days from discovery, and a detailed written report shall follow within ten days after notification to the Department. The written report shall detail what problem has occurred and remedial measures that have been taken to prevent recurrence or request approval for replacement of the monitoring well. All monitoring well design and replacement shall be approved by the Department's Northeast District Office before installation. *[62-520.600(6)(l)]*

12. With the application for permit renewal, the permittee shall submit results of sampling monitoring well(s) **MWI-2S** for the primary and secondary drinking water parameters listed in Tables 1, 4 and 6 of Chapter 62-550, (*excluding asbestos, color and odor*). Sampling shall occur no sooner than 180 days before submittal of the renewal application. *NOTE: Laboratory report is acceptable for submittal - no transcription to other reporting format is required. [62-520.600(5)(b)]*

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

A. Part II Slow-Rate/Restricted Access System(s)

1. Advisory signs shall be posted around the site boundaries to designate the nature of the project area. *[62-610.418(1)]*

2. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. *[62-610.414(8)]*

3. The hydraulic loading rate shall not produce surface runoff or ponding of the applied reclaimed water. *[62-610.423(3) and (4)]*

4. The crops or vegetation shall be periodically harvested and removed from the project area. *[62-610.310(3)(d) and 62-610.419(1)(b)]*

5. Dairy cattle whose milk is intended for human consumption shall not be allowed on the project area for a period of 15 days after the last application of reclaimed water. No restrictions are imposed on the grazing of other cattle. *[62-610.425]*

6. Irrigation of edible food crops is prohibited unless the requirements of Part III of Chapter 62-610, F.A.C., are met. *[62-610.100(9)(c), 62-610.460, and 62-610.475]*

7. Overflows from emergency discharge facilities on storage ponds shall be reported as abnormal events in accordance with Permit Condition IX.20. *[62-610.800(9)]*

Blending of Leachate with Reclaimed Water

8. Leachate from Columbia County Winfield Class I MSW Landfill is off-loaded to on site storage tanks, pumped and metered at a low rate into the WWTF influent pump station where it combines with the domestic wastewater for treatment. Monitoring site INF-1 will monitor influent quality. *[62-610.865]*

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the wastewater facilities shall be operated under the supervision of one or more operators certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C., this facility is a Category II, Class C facility and, at a minimum, operators with appropriate certification must be on the site as follows:

   A Class C or higher operator 6 hours/day for 5 days/week and one visit on each weekend day. The lead/chief operator must be a Class C operator, or higher.

2. An operator meeting the lead/chief operator class for the plant shall be available during all periods of plant operation. "Available" means able to be contacted as needed to initiate the appropriate action in a timely manner. *[62-699.311(1)]*

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

1. The application to renew this permit shall include an updated capacity analysis report prepared in accordance with Rule 62-600.405, F.A.C. *[62-600.405(5)]*

2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. *[62-600.735(1)]*

C. Recordkeeping Requirements

1. The permittee shall maintain the following records and make them available for inspection at the following address: on the site of the permitted facility.
   a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, including, if applicable, a copy of the laboratory certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;
   b. Copies of all reports required by this permit for at least three years from the date the report was prepared;
   c. Records of all data, including reports and documents, used to complete the application for this permit for at least three years from the date the application was filed;
   d. Monitoring information, including a copy of the laboratory certification showing the laboratory certification number, related to the residuals use and disposal activities for the time period set forth in Chapter 62-640, F.A.C., for at least three years from the date of sampling or measurement;

e. A copy of the current wastewater facility permit;

f. Copies of the current operation and maintenance manuals for the wastewater facility and the collection/transmission systems owned or operated by the wastewater facility permittee as required by Chapters 62-600 and 62-604, F.A.C.;

g. A copy of any required record drawings for the wastewater facility and the collection/transmission systems owned or operated by the wastewater facility permittee;

h. Copies of the licenses of the current certified operators;

i. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed; and

j. Records of biosolids quantities, treatment, monitoring, and hauling for at least five years.

[62-620.350, 62-604.500, 62-602.650, 62-640.650(4)]

VI. SCHEDULES

1. Prior to placing the new facilities into operation or any individual unit processes into operation, for any purpose other than testing for leaks and equipment operation, the permittee shall complete and submit to the Department DEP Form 62-620.910(12), Notification of Completion of Construction for Wastewater Facilities or Activities. *[62-620.410(7) and 62-620.630(2)]*

2. Within six months after a facility is placed in operation, the permittee shall provide written certification to the Department on Form 62-620.910(13) that record drawings pursuant to Chapter 62-620, F.A.C., and that an operation and maintenance manual pursuant to Chapters 62-600 and 62-610, F.A.C., as applicable, are available at the location specified on the form. *[62-620.410(6) and 62-620.630(7)]*

3. The permittee is not authorized to discharge to waters of the state after the expiration date of this permit, unless:

   a. The permittee has applied for renewal of this permit at least 180 days before the expiration date of this permit using the appropriate forms listed in Rule 62-620.910, F.A.C., and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C.; or

   b. The permittee has made complete the application for renewal of this permit before the permit expiration date.

   [62-620.335(1)-(4)]

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

1. This facility is not required to have a pretreatment program at this time. *[62-625.500]*

VIII. OTHER SPECIFIC CONDITIONS

1. In the event that the wastewater facilities or equipment, including collection/transmission systems, no longer function as intended, are no longer safe in terms of public health and safety (including inactive or abandoned facilities), or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by paragraphs 62-600.400(2)(a) and 62-604.400(2)(c), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in subsection 62-296.320(2), F.A.C. *[62-600.410(5), 62-604.500(3) and 62-640.400(6)]*

2. All collection/transmission systems shall be operated and maintained so as to provide uninterrupted service. *[62-604.500(2)]*

3. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. *[62-604.130(4)]*

4. Cross-connection, as defined in Rule 62-550.200, F.A.C., between the wastewater facility, including the collection/transmission system, and a potable water system is prohibited. *[62-550.360][62-604.130(3)]*

5. The collection/transmission operation and maintenance manual shall be maintained and revised periodically in accordance with subsection 62-604.500(4), F.A.C., to reflect any alterations performed or to reflect experience resulting from operation. However, a new operation and maintenance manual is not required to be developed for each project if there is already an existing manual that is applicable to the facilities being constructed. *[62-604.500(4)]*

6. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX.20. *[62-604.550] [62-620.610(20)]*

7. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):

   a. Which may cause fire or explosion hazards; or
   b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or
   c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or
   d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding $40^{o}C$ or otherwise inhibiting treatment; or
   e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health and safety problems.

   [62-604.130(5)]

8. The treatment facility, storage ponds for Part II systems, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. *[62-610.418(1) and 62-600.400(2)(b)]*

9. Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of screenings and grit. *[62-701.300(1)(a)]*

10. Where required by Chapter 471 or Chapter 492, F.S., applicable portions of reports that must be submitted under this permit shall be signed and sealed by a professional engineer or a professional geologist, as appropriate. *[62-620.310(4)]*

11. The permittee shall provide verbal notice to the Department's Northeast District Office as soon as practical after discovery of a sinkhole or other karst feature within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department's Northeast District Office in a written report within 7 days of the sinkhole discovery. *[62-620.320(6)]*

12. The permittee shall provide notice to the Department of the following:

    a. Any new introduction of pollutants into the facility from an industrial discharger which would be subject to Chapter 403, F.S., and the requirements of Chapter 62-620, F.A.C., if it were directly discharging those pollutants; and

    b. Any substantial change in the volume or character of pollutants being introduced into that facility by a source which was identified in the permit application and known to be discharging at the time the permit was issued.

    Notice shall include information on the quality and quantity of effluent introduced into the facility and any anticipated impact of the change on the quantity or quality of effluent or reclaimed water to be discharged from the facility. If pretreatment becomes necessary, this permit may be modified to require the permittee to develop and implement a local pretreatment program in accordance with the requirements of Chapter 62-625, F.A.C.

    [62-620.625(2)]

IX. GENERAL CONDITIONS

1. The terms, conditions, requirements, limitations, and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. *[62-620.610(1)]*

2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications, or conditions of this permit constitutes grounds for revocation and enforcement action by the Department. *[62-620.610(2)]*

3. As provided in subsection 403.087(7), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or

authorization that may be required for other aspects of the total project which are not addressed in this permit. *[62-620.610(3)]*

4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. *[62-620.610(4)]*

5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. *[62-620.610(5)]*

6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. *[62-620.610(6)]*

7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. *[62-620.610(7)]*

8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. *[62-620.610(8)]*

9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:

    a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;

    b. Have access to and copy any records that shall be kept under the conditions of this permit;

    c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and

    d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

    [62-620.610(9)]

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, F.S., or Rule 62-620.302, F.A.C. Such evidence shall only be

used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. *[62-620.610(10)]*

11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. *[62-620.610(11)]*

12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. *[62-620.610(12)]*

13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. *[62-620.610(13)]*

14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. *[62-620.610(14)]*

15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility or activity and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. *[62-620.610(15)]*

16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300, F.A.C., and the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2), F.A.C., for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. *[62-620.610(16)]*

17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:

    a. A description of the anticipated noncompliance;

    b. The period of the anticipated noncompliance, including dates and times; and

    c. Steps being taken to prevent future occurrence of the noncompliance.

    [62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246 and Chapters 62-160, 62-600, and 62-610, F.A.C., and 40 CFR 136, as appropriate.

    a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10), or as specified elsewhere in the permit.

    b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

    c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.

    d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.

    e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.

    f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220, and 62-160.330, F.A.C.

    [62-620.610(18)]

19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. *[62-620.610(19)]*

20. The permittee shall report to the Department any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; clean up actions taken and status; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance. For noncompliance events related to sanitary sewer overflows, bypass events, or unauthorized discharges, these reports must include the data described above (with the exception of time of discovery) as well as the type of event (e.g., sanitary sewer overflow, bypass, unauthorized discharge); type of sanitary sewer overflow structure (e.g., manhole); the discharge location address and latitude/longitude; type of water discharged; discharge volumes and volumes recovered; volume discharged to surface waters and receiving waterbody name; types of human health and environmental impacts of the sanitary sewer overflow, bypass event, or unauthorized discharge (e.g., beach closure); whether the noncompliance was caused by a third party; and whether the noncompliance was related to wet weather. The written submission may be provided electronically using the Department's Business Portal at https://www.fldepportal.com/go/ (via "Submit" followed by "Report" or "Registration/Notification"). Notice required for public notice of pollution under paragraph (d) may be provided together with the written submission using the Business Portal. All noncompliance events related to sanitary sewer overflows or bypass events submitted after (effective date of rule), shall be submitted electronically.

a. The following shall be included as information which must be reported within 24 hours under this condition:
   (1) Any unanticipated bypass which causes any reclaimed water or the effluent to exceed any permit limitation or results in an unpermitted discharge,
   (2) Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
   (3) Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice; and,
   (4) Any unauthorized discharge to surface or groundwaters, except for discharges to groundwater of reclaimed water meeting Part III or Part V treatment standards under Chapter 62-610, F.A.C.

b. Oral reports as required by this subsection shall be provided as follows:
   (1) For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph (a)4., that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the Department by calling the STATE WATCH OFFICE TOLL FREE NUMBER (800)320-0519, as soon as practicable, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Watch Office:
      (a) Name, address, and telephone number of person reporting,
      (b) Name, address, and telephone number of permittee or responsible person for the discharge,
      (c) Date and time of the discharge and status of discharge (ongoing or ceased),
      (d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater),
      (e) Estimated amount of the discharge,
      (f) Location or address of the discharge,
      (g) Source and cause of the discharge,
      (h) Whether the discharge was contained on-site, and cleanup actions taken to date,
      (i) Description of area affected by the discharge, including name of water body affected, if any; and,
      (j) Other persons or agencies contacted.
   (2) Oral reports, not otherwise required to be provided pursuant to subparagraph (b)1., above, shall be provided to the Department within 24 hours from the time the permittee becomes aware of the circumstances.

c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department shall waive the written report.

d. In accordance with Section 403.077, F.S., unauthorized releases or spills reportable to the State Watch Office pursuant to subparagraph (b)1. above shall also be reported to the Department within 24 hours from the time the permittee becomes aware of the discharge. The permittee shall provide to the Department information reported to the State Watch Office. Notice of unauthorized releases or spills may be provided to the Department through the Department's Public Notice of Pollution web page at https://floridadep.gov/pollutionnotice or by reporting electronically using

the Department's Business Portal at https://www.fldepportal.com/go/ (via "Submit" followed by "Report" or "Registration/Notification").

(1) If, after providing notice pursuant to paragraph (d) above, the permittee determines that a reportable unauthorized release or spill did not occur or that an amendment to the notice is warranted, the permittee may submit a letter to the Department documenting such determination at pollution.notice@floridadep.gov.

(2) If, after providing notice pursuant to paragraph (d) above, the permittee discovers that a reportable unauthorized release or spill has migrated outside the property boundaries of the installation, the permittee must provide an additional notice to the Department that the release has migrated outside the property boundaries within 24 hours after its discovery of the migration outside of the property boundaries.

e. Unless discharged to surface waters, a spill, release, discharge, upset or bypass involving reclaimed water meeting Part III or Part V treatment standards under Chapter 62-610, F.A.C., shall not be considered to endanger health or the environment and shall be reported under subsection (21) of this permit.

[62-620.610(20)] [62-620.100(3)]

21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX.17., IX.18., or IX.19. of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX.20. of this permit. *[62-620.610(21)]*

22. Bypass Provisions.

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment works.

b. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:

(1) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and

(2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(3) The permittee submitted notices as required under Permit Condition IX.22.c. of this permit.

c. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX.20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass, including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

d. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX.22.b.(1) through (3) of this permit.

e. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX.22.b. through d. of this permit.

[62-620.610(22)]

23. Upset Provisions.

    a. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee.

        (1) An upset does not include noncompliance caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, careless or improper operation.

        (2) An upset constitutes an affirmative defense to an action brought for noncompliance with technology based permit effluent limitations if the requirements of upset provisions of Rule 62-620.610, F.A.C., are met.

    b. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:

        (1) An upset occurred and that the permittee can identify the cause(s) of the upset;

        (2) The permitted facility was at the time being properly operated;

        (3) The permittee submitted notice of the upset as required in Permit Condition IX.20. of this permit; and

        (4) The permittee complied with any remedial measures required under Permit Condition IX.5. of this permit.

    c. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.

    d. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Thomas G. Kallemeyn
Permitting Program Administrator

Date: February 21, 2022

Attachment(s):
Discharge Monitoring Report

STATEMENT OF BASIS
FOR
STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMIT NUMBER: FLAB07233-001

FACILITY NAME: North Florida Mega Industrial Park (NFMIP) WWTF

FACILITY LOCATION: 153 Southeast Tyre Road, Lake City, FL 32025
Columbia County

NAME OF PERMITTEE: Columbia County Board Commissioners

PERMIT WRITER: Jeff Martin, P.E., John Davis, P.G.

PERMIT REVIEWER: D. A. Vo, P.E.,

1. SUMMARY OF APPLICATION

a. Chronology of Application

Application Number: FLAB07233-001-DW1P

Application Submittal Date: July 1, 2021

RAI: August 4, 2021

RAI responses complete: November 1, 2021

Notice of Complete Application: November 19, 2021

Publication of Notice: November 23, 2021

Public Notice of Intent: January 11, 2022

Publication of Intent: January 26, 2022

Notice of Permit: February 21, 2022

b. Type of Facility

Domestic Wastewater Treatment Plant

Ownership Type: County

SIC Code: 4952

c. Facility Capacity

Existing Permitted Capacity:	0.00 mgd Annual Average Daily Flow
Proposed Increase in Permitted Capacity:	0.51 mgd Annual Average Daily Flow
Proposed Total Permitted Capacity:	0.51 mgd Annual Average Daily Flow

d. Description of Wastewater Treatment

Phase I
The NFMIP WWTP will include construction of a 0.500 MGD AADF, Category 1, Class C, 4-Stage Bardenpho package wastewater treatment plant which includes headworks, equalization tanks, waste sludge aerobic digesters and associated pumps, blowers, and appurtenances. The package plant will meet the Santa Fe BMAP requirements to produce a reclaimed water with a Total-Nitrogen (TN) of less than or equal to 3.0 mg/L-TN on an Average Annual Basis. The reclaimed water will be land applied on a 177- acre restricted access spray field. The land is owned by Weyerhaeuser and provided to the County for the economic development and job creation within the NFMIP. The associated WWTP that will serve NFMIP customers. Weyerhauser is also providing the existing silviculture land for the NFMIP WWTP effluent spray field to the County for an interim period (5 to 10-years) to serve the Phase I WWTP. The

Phase I WWTP will include the following:

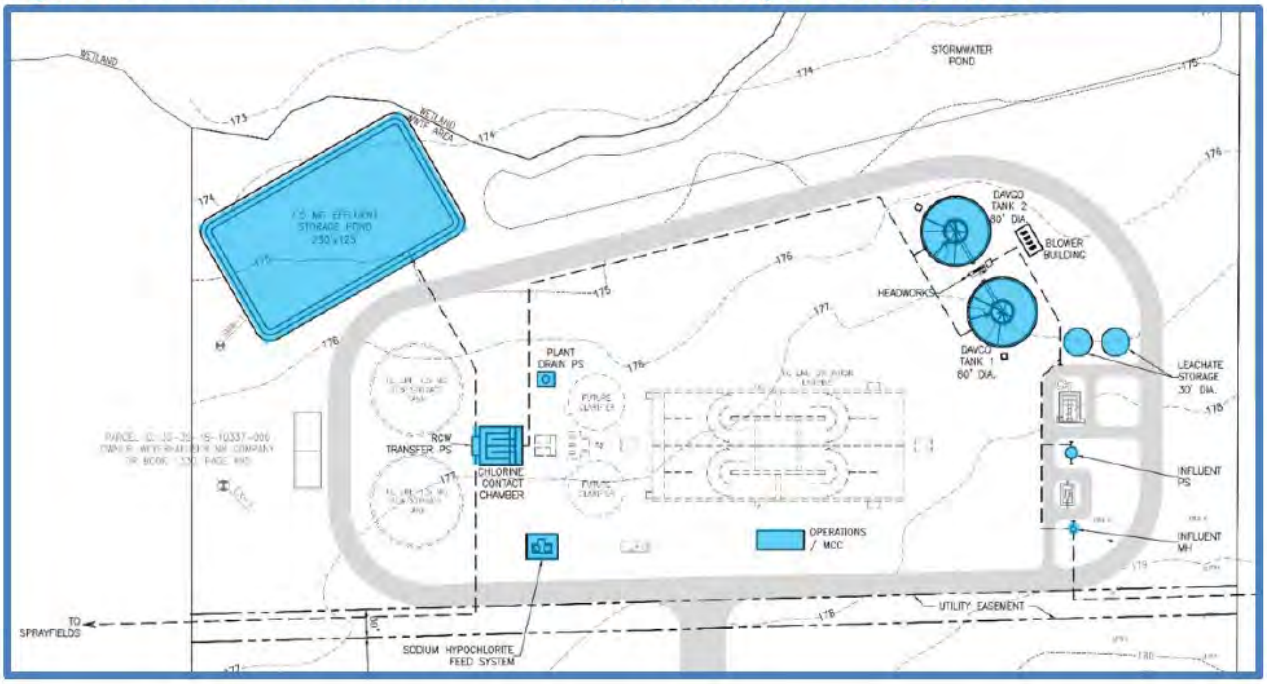
- A master influent pump station designed for Phase 1 peak-hour flow (PHF) of 1.5 MGD, and future PHF of 4.5 MGD.
- An influent headworks structure consisting of two-mechanical drum screens of 1.5 MGD peak hour flow capacity and a manual bypass screen.
- A 1,365,000 million-gallon (MG) volume package plant with equalization and configured as a 4-Stage Bardenpho unit treatment process. The package plant consists of the following: (two- 211,000 gallon equalization tanks for a total volume of 422,000 gallons; two-74,000 gallon Stage 1 anoxic zones for a total volume of 148,000 gallons; an internal recycle (nitrate recycle) pump station of 3.0 MGD (Anoxic Recycle Ratio of 300 to 600% of influent Q); two-187,000 gallon aeration zones with fine bubble diffusers and PD Blowers for a total volume of 374,000 gallon; two-35,500 gallon 2nd Anoxic Basins and two-5,000 gallon re-aeration basins for a total of 81,000 gallons. Two secondary clarifiers of 89,000 gallons/each and 881 square feet/each of surface area for a total volume of 178,000 gallons and two aerobic digesters of 81,000 gallons/each for a total volume of 162,000 gallons.
- Addition of supplemental carbon feed system to optimize the Total-Nitrogen removal capabilities for the 4-Stage BNR WWTP.
- A cast-in place chlorine contact tank (CCT) split in two chambers, each of 75,000 gallons for a total volume of 150,000 gallons; disinfection is achieved by a chemical feed system using sodium hypochlorite.
- A clearwell at the end of the CCT contains two 700 gpm reclaim water transfer pumps and is connected to a lined 1.5 MG reclaim water storage pond to allow 3-days storage at design AADF.

The package plant will be operated to provide advanced secondary treatment and basic level disinfection.

Biosolids will be aerobically digested, decant thickened, and hauled by truck to a Residuals Management Facility (RMF) or be Land Applied by Contract Hauler to a FDEP permitted site.

An FDEP UIC Permit Application for a UIC Class 5 exploratory well and monitoring wells was submitted for construction of an exploratory well for a Class I Municipal Deep Injection Well to provide 100% backup disposal of excess reclaim water for the WWTP.

Figure ES-1 Phase 1 – 0.500-MGD 4-Stage Bardenpho Package WWTP



Phase II – Public Access Reclaimed Water Improvements– (phase II to be permitted later).

Phase II improvements include the addition of effluent filters to provide high-level disinfection for unrestricted public access reuse water, associated storage and reclaim water high service pumping, and construction of a Class I DIW to provide 100% backup disposal. Construction of modifications to the 0.500 MGD, AADF, Category I, Class C, package wastewater treatment plant to provide effluent disk filters to produce high-level disinfected reclaim water for unrestricted public access reuse to the customers in the NFMIP and use the 162-acre restricted access sprayfield for excess reuse water disposal and consist of the following improvements:

- Addition of two- effluent disk filters with 5-micron filter filters and each unit is designed for 1.5 MGD PHF.
- The package plant will be operated to provide advanced secondary treatment and high-level disinfection.
- Addition of a 1.5 MGD reclaimed water storage tank and high-service pump station for transmission of reclaim water to NFMIP customers.
- Construction the UIC Class 5 exploratory well and monitoring wells, completion of the well completion report, and finalize design for injection well pumps, surface piping and related surface facilities for a Class I Municipal Deep Injection Well to provide 100% backup disposal of excess reclaim water for the WWTP.
- The plant will be operated to provide tertiary treatment and high-level disinfection.
- Biosolids will be aerobically digested, decant thickened, and hauled by truck to a Residuals
- Management Facility (RMF) or be Land Applied by Contract Hauler to a FDEP permitted site.

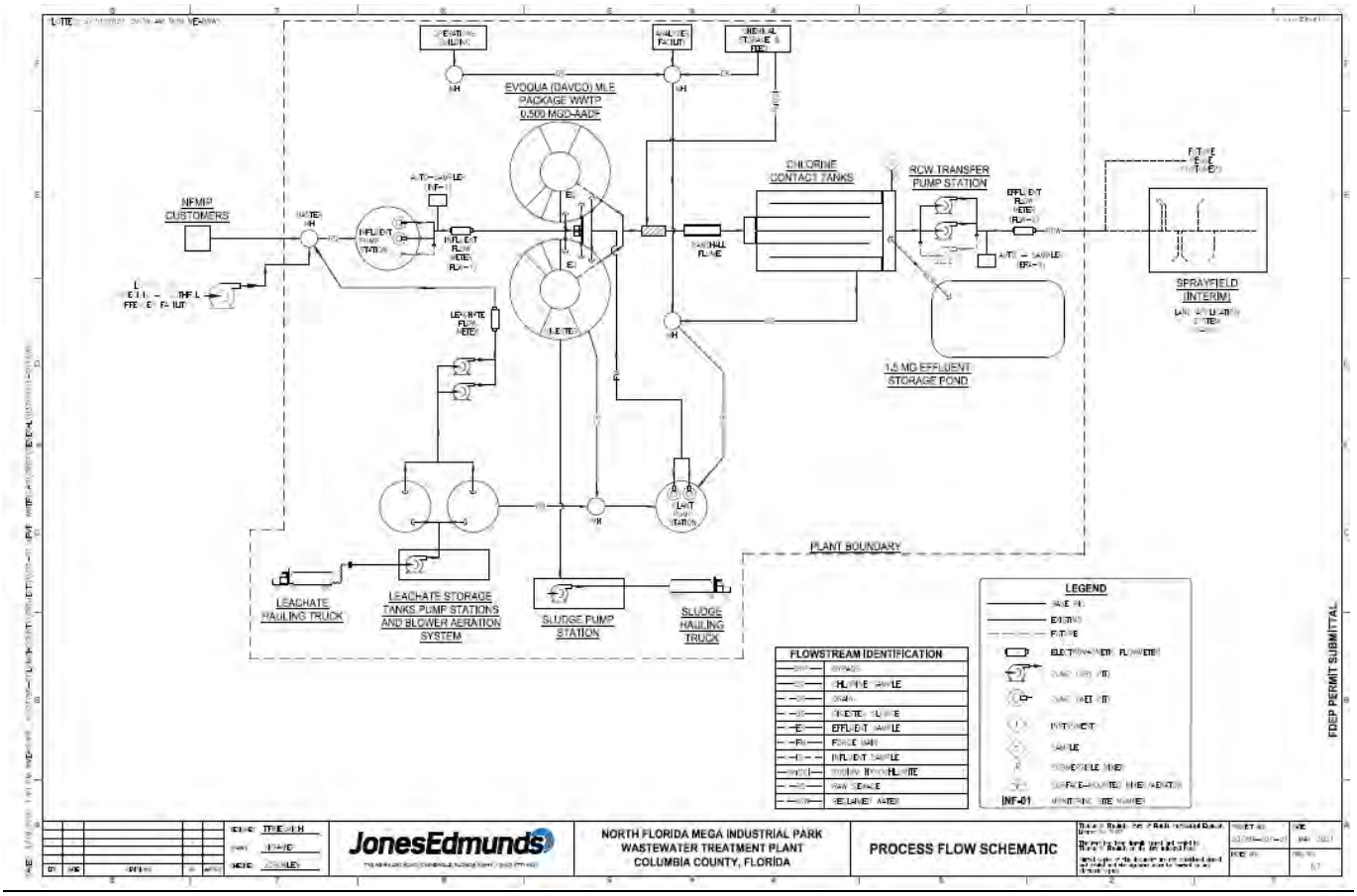
Phase III – NFMIP WWTP Expansion to 1.5 MGD AADF (phase III to be permitted later)..
The Phase III WWTP includes an expansion to 1.5 MGD AADF with the addition of new headworks with mechanical screening and grit removal, two 4-Stage Bardenpho Treatment Tanks, two- Final Clarifiers and

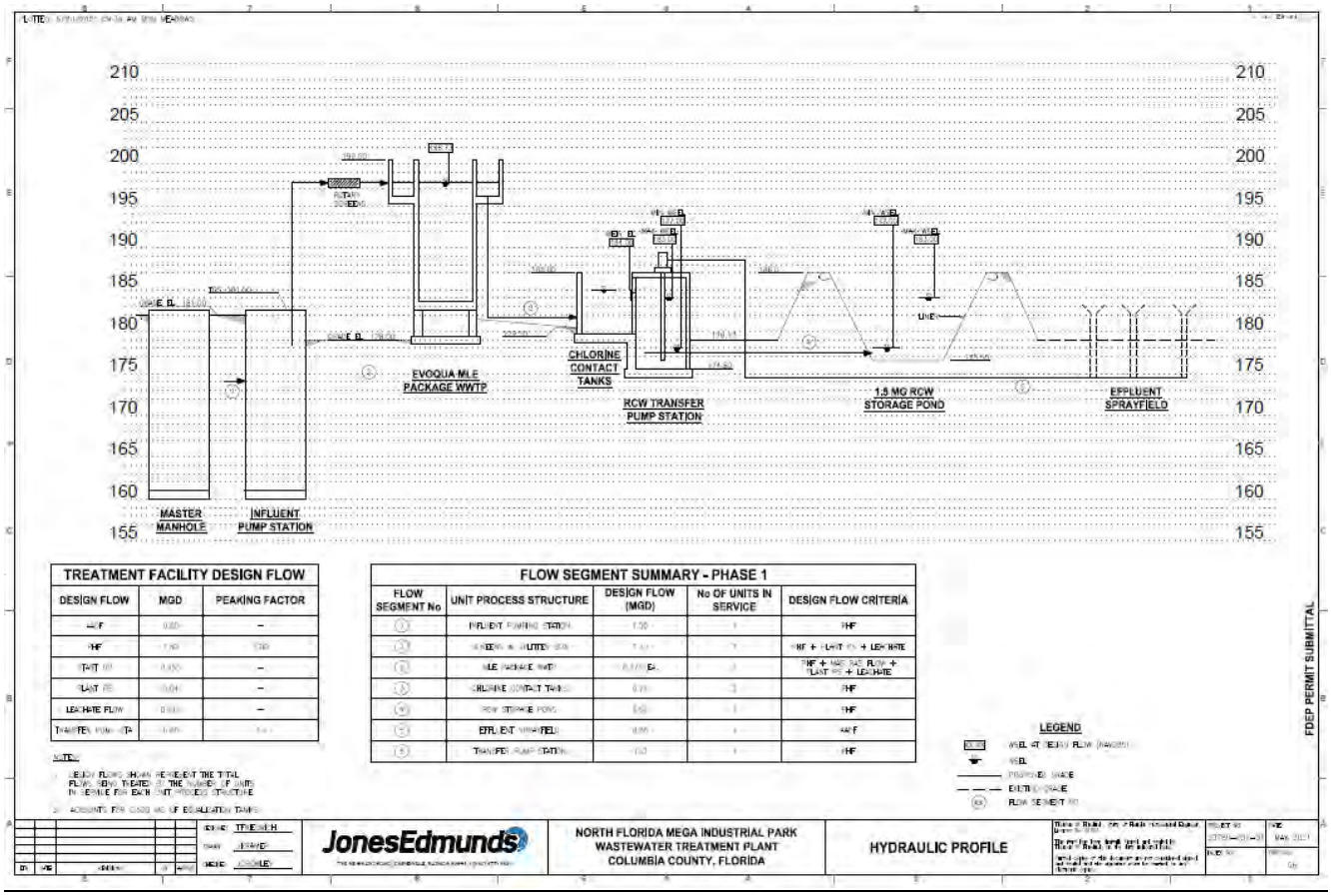
operation of the 2-MGD DIW as 100% backup to the public access reclaim water system (to be permitted later).

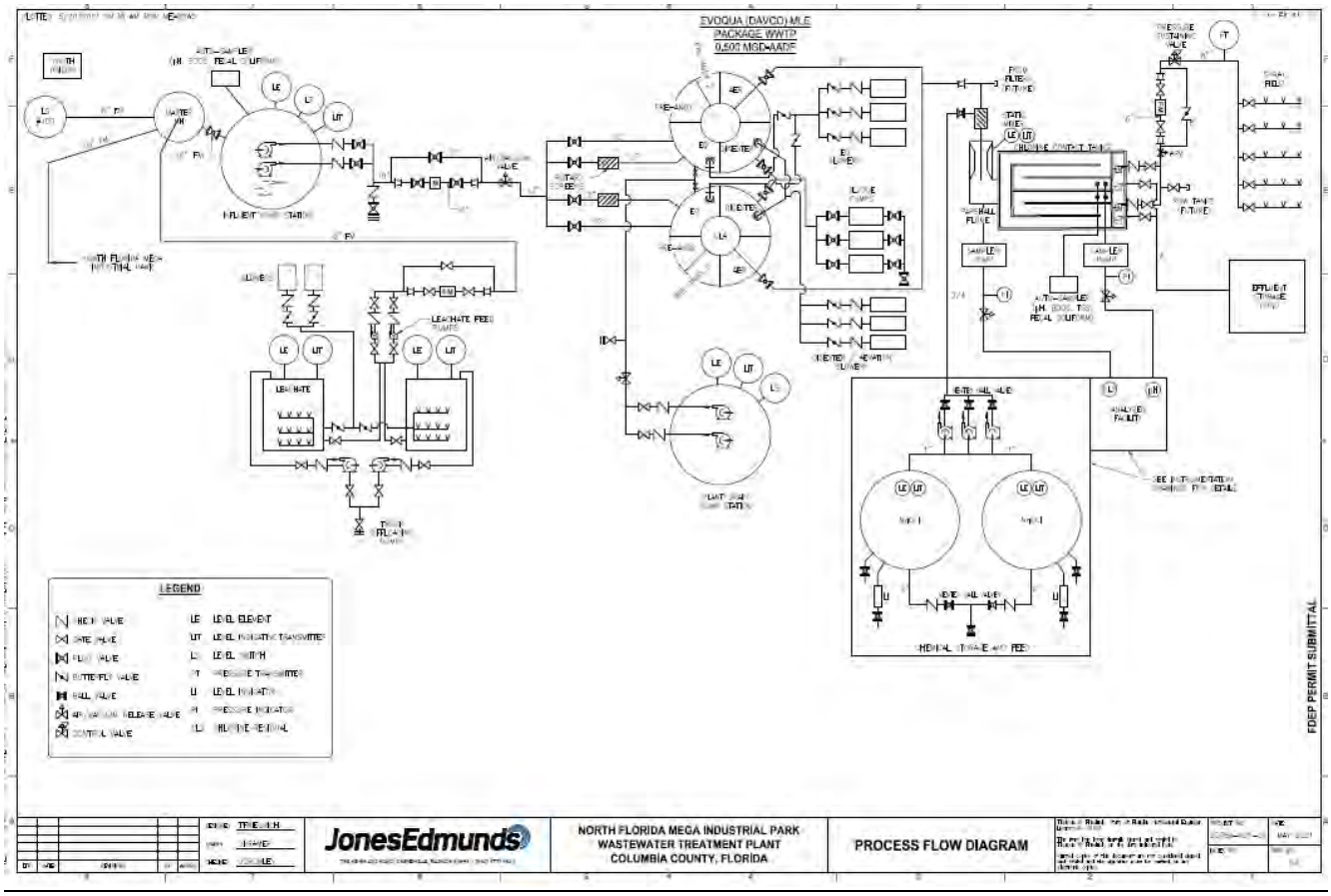
Wastewater treatment facility with a permitted design capacity of 0.500 MGD AADF, Class III reliability. The facility will provide basic level disinfection.

This facility is designed to provide wastewater treatment for the North Florida Mega Industrial Park (NFMIP) and can also provide wastewater collection to the Lake City service area, Columbia County Winfield Class I MSW Landfill leachate, Core Civic Lake City Correctional Facility for Youthful Offenders by local agreement.

The facility is to be located at the City of Lake City, SR 90, the east side of Columbia County Correctional Facility. The treated wastewater will be land applied to the R-001 slow rate land application reuse system for a total design capacity of 0.500 MGD AADF. The East Segment 1 is 99 acres, at 0.75 inches/week, permitted capacity of 0.290 MGD AADF, the West Segment 2 is 63 acres 0.86 inches/week, permitted capacity of 0.210 MGD AADF.



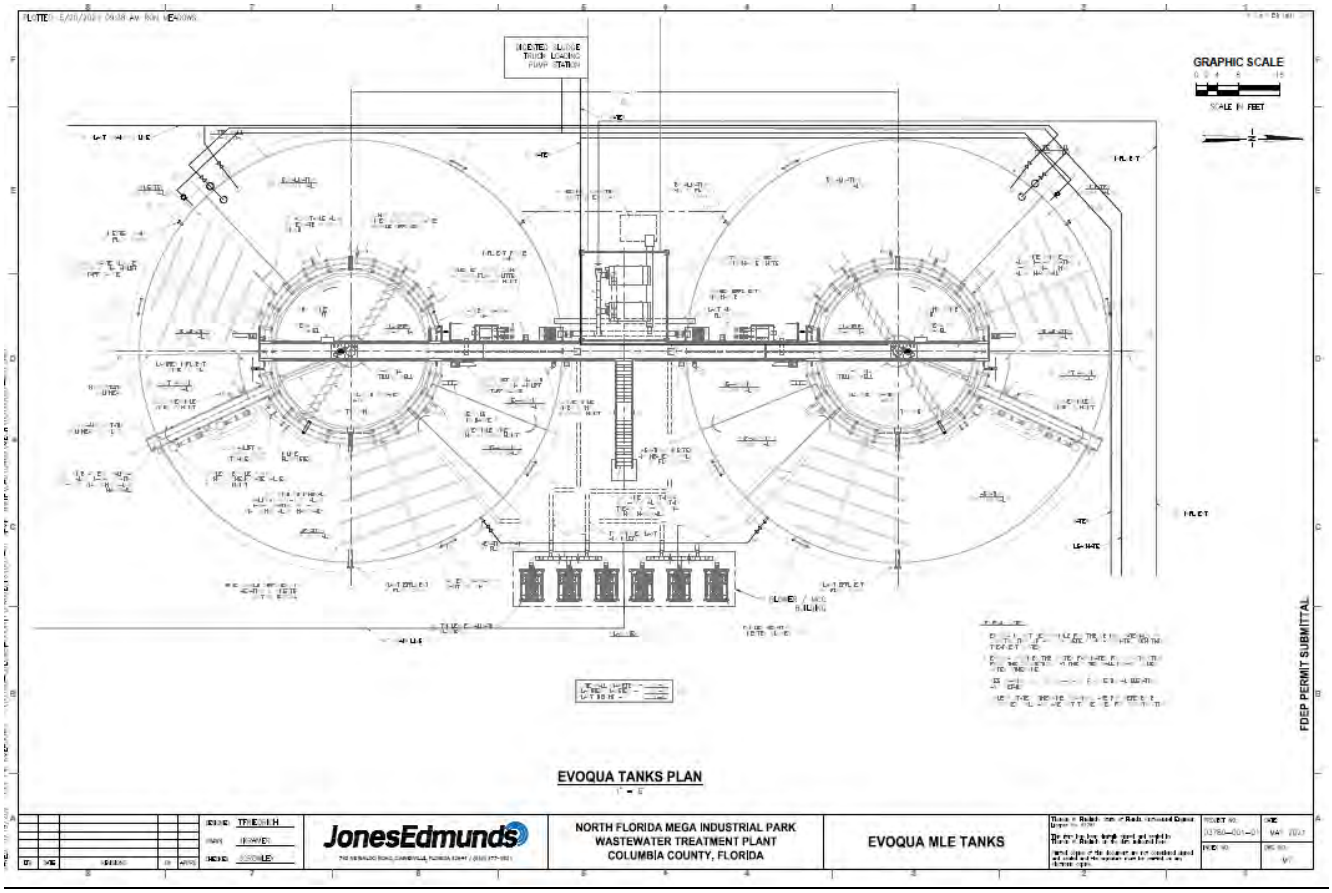

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MASTER MANHOLE
INFLUENT PUMP STATION
EVOQUA MLE PACKAGE WWTP
CHLORINE CONTACT TANKS
RCW TRANSFER PUMP STATION
1.8 MG RCW STORAGE POND
EFFLUENT SPRAYFIELD
TREATMENT FACILITY DESIGN FLOW
DESIGN FLOW
MGD
PEAKING FACTOR
AADF
PHF
PLANT I/F
PLANT I/S
LEACHATE FLOW
TRANSFER PUMP STATION
FLOW SEGMENT SUMMARY - PHASE 1
FLOW SEGMENT No
UNIT PROCESS STRUCTURE
DESIGN FLOW (MGD)
No OF UNITS IN SERVICE
DESIGN FLOW CRITERIA
INFLUENT PUMPING STATION
PHF
SCREENS & UTILITY SEA
PHF + PLANT I/S + LEACHATE
MLE PACKAGE PLANT
PHF + RAS RAS FLOW + PLANT I/S + LEACHATE
CHLORINE CONTACT TANK
PHF
RCW STORAGE POND
PHF
EFFLUENT SPRAYFIELD
AADF
TRANSFER PUMP STATION
PHF
LEGEND
WSEL AT DESIGN FLOW (MAXIMUM)
WSEL
PROPOSED GRADE
EXISTING GRADE
FLOW SEGMENT NO
NOTES:
1. DESIGN FLOWS SHOWN REPRESENT THE TOTAL FLOW BEING TREATED BY THE NUMBER OF UNITS IN SERVICE FOR EACH UNIT PROCESS STRUCTURE
2. ASSUMES FIVE (5) DAYS OF EQUALIZATION TANK
JonesEdmunds
NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA
HYDRAULIC PROFILE
FDEP PERMIT SUBMITTAL



BNR Stage-2 Aeration Basin		
Positive Displacement Blowers and Fine Bubble Diffusers		
Aerator Type	**PD Blower with Fine-Bubble Diffusers**	**Sized for 0.5-MGD AADF and peak day load conditions.**
Manufacturer (Basis of Design)	**Robuschi**	
Number of Blowers per Basin	**One**	**Provide 1.1 pounds O_2/lb MMAD BOD, 0.5 lb O_2/lb (PD BOD-MMAD BOD), and 4.6 lbs O_2/lb MMAD TKN.**
Total Number of Blowers	**Three (two duty, one standby)**	**Assume SOTR = 25%, α = 0.55, β = 0.96.**
Total O_2 Required (SCFM) – Peak Day	**880**	
Side Water Depth (feet)	**19**	

BNR Stage-2 Aeration Basin		
Aerobic Digester – Positive-Displacement Blowers with Fine-Bubble Diffusers		
Volume of Aerobic Digester Basin No.3A (MG)	0.080	MLSS concentration = 4,150 mg/L.
Volume of Aerobic Digester Basin No.3B (MG)	0.080	
Total volume of Anoxic Basins (MG)	0.160	
Total volume of Anoxic Basins (ft^3)	21,400	
Side Water Depth (feet)	18	
Total SCFM for Aerobic Digester	430	Total SCFM based on 20 SCFM per 1,000 ft^3 for Aerobic Digester.
Combined Air Flow for Package WWTF (SCFM)	1,310	Minimum DO concentration = 2.0 mg/L; Maximum design temperature = 30°C.
Airflow per PD Blower (SCFM)/each	655	Three blowers (2 duty, 1 standby)
Blower Discharge Pressure (psig)	10	
Aerator Motor Hp each	50	
Total Operating Motor Hp	100	
Voltage/Phase/Hz	480/three/60	
Controls	SCADA/PLC Control	Provide variable speed PD blowers with fine bubble diffusers with DO control.

Notes: PD = positive displacement; O_2/lb = oxygen per pound;
MMAD = maximum month average day; BOD = biochemical oxygen demand;
TKN = total Kjeldahl nitrogen; SOTR = Standard Oxygen Transfer Rate;
SCFB = standard cubic feet per minute; MG = million gallons;
MLSS = mixed liquor suspended solids; ft^3 = cubic feet; °C = degrees Celsius;
psig = pounds per square inch gauge; PLC = programmable logic controllers.



e. Description of Effluent Disposal and Land Application Sites (as reported by applicant)

See attached map(s) for effluent disposal and land application site(s).

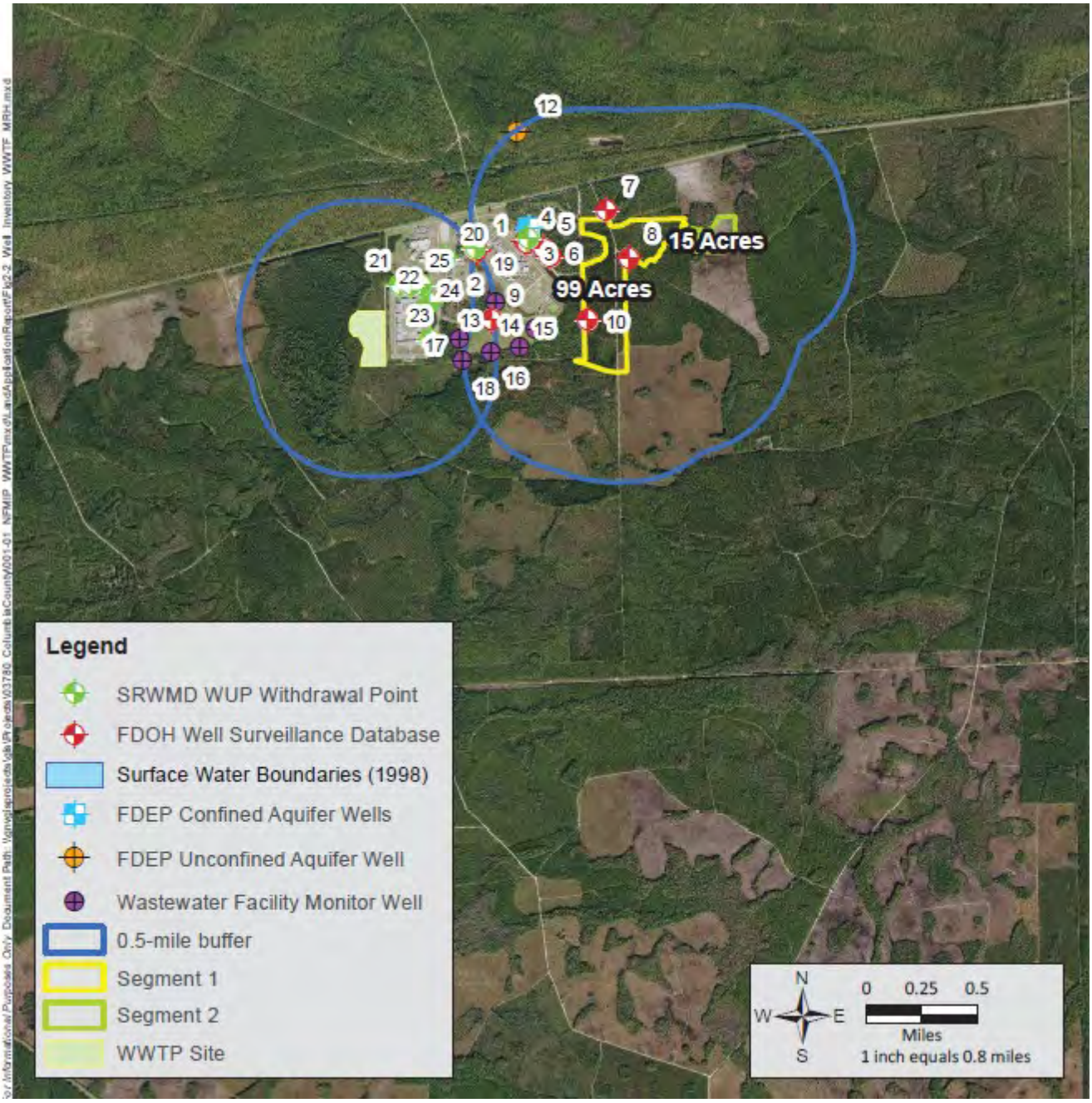
Land Application R-001: A new 0.500 MGD annual average daily flow permitted capacity slow-rate restricted public access (except subsurface) system. R-001 is a reuse system which consists of

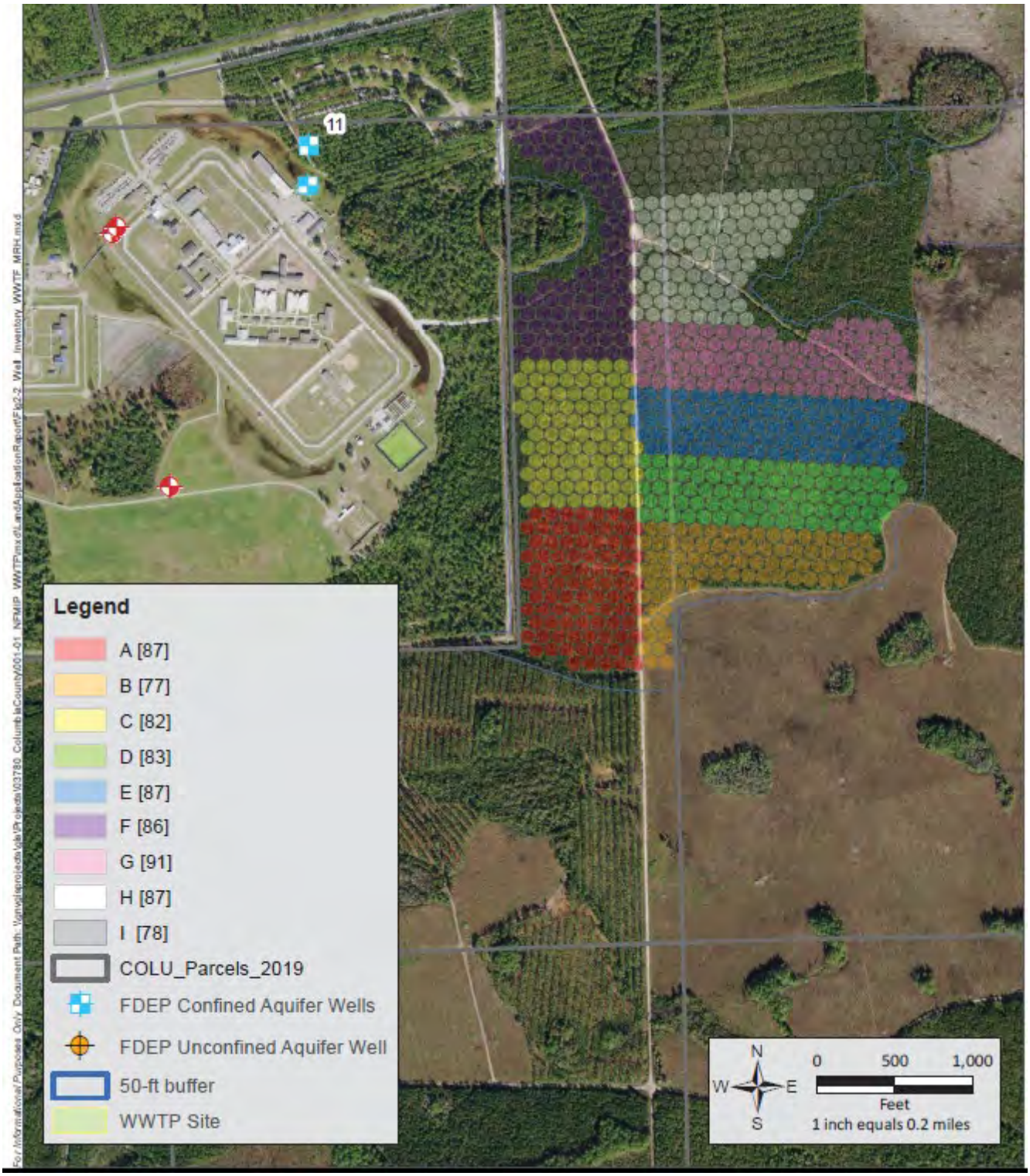
The final treated effluent is pumped to a 177-acre sprayfield. The sprayfield consists of:

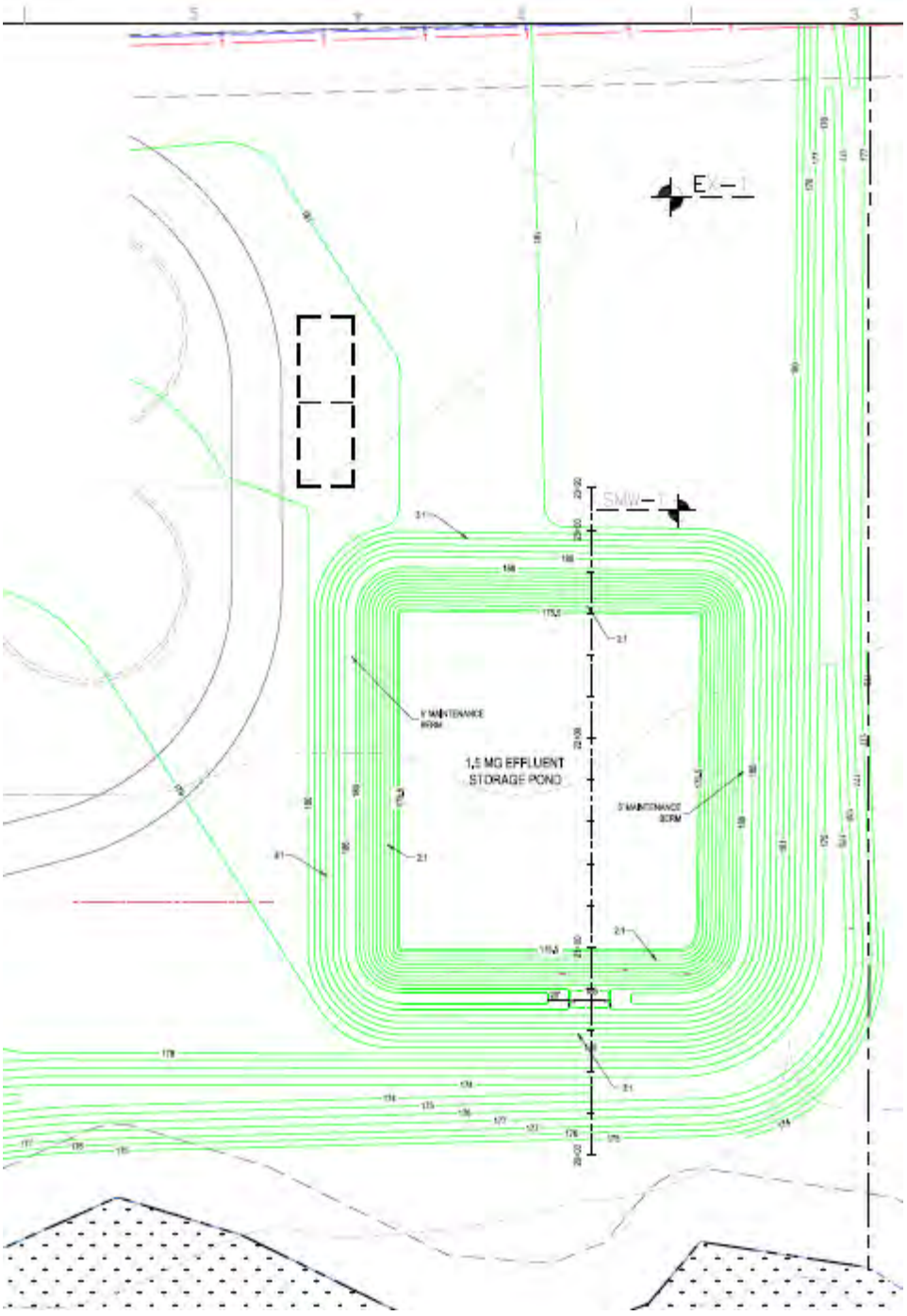
Segment 1 – 99 acres for irrigation of reclaimed water. Segment 1 will be constructed first and provide disposal of 0.290 MGD of reclaimed water.

Segment 2 – 78 acres for irrigation of reclaimed water will be constructed as additional customers are connected and provide disposal of 0.220 MGD of reclaimed water for a total disposal capacity of 0.510 MGD

Demineralization concentrate is blended with reclaimed water going to the slow-rate restricted public access (except subsurface) R-001.




11
Legend
A [87]
B [77]
C [82]
D [83]
E [87]
F [86]
G [91]
H [87]
I [78]
COLU_Parcels_2019
FDEP Confined Aquifer Wells
FDEP Unconfined Aquifer Well
50-ft buffer
WWTP Site
N
W
E
S
0
500
1,000
Feet
1 inch equals 0.2 miles



2. SUMMARY OF SURFACE WATER DISCHARGE

This facility does not discharge to surface waters.

3. BASIS FOR PERMIT LIMITATIONS AND MONITORING REQUIREMENTS

This facility is authorized to direct reclaimed water to Reuse System R-001, a slow-rate/restricted public access system, based on the following:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	0.500	Annual Average	62-600.700(2)(b) & 62-610.810(5) FAC
		Max	Report	Monthly Average	62-600.700(2)(b) & 62-610.810(5) FAC
BOD, Carbonaceous 5 day, 20C	mg/L	Max	20.0	Annual Average	62-610.410 & 62-600.420(3)(a)1. FAC
		Max	30.0	Monthly Average	62-610.410 & 62-600.420(3)(a)2. FAC
		Max	45.0	Weekly Average	62-610.410 & 62-600.420(3)(a)3. FAC
		Max	60.0	Single Sample	62-610.410 & 62-600.420(3)(a)4. FAC
Solids, Total Suspended	mg/L	Max	20.0	Annual Average	62-610.410 & 62-600.420(3)(b)1. FAC
		Max	30.0	Monthly Average	62-610.410 & 62-600.420(3)(b)2. FAC
		Max	45.0	Weekly Average	62-610.410 & 62-600.420(3)(b)3. FAC
		Max	60.0	Single Sample	62-610.410 & 62-600.420(3)(b)4. FAC
Coliform, Fecal	#/100mL	Max	200	Annual Average	62-62-600.440(5)(a)1 FAC
		Max	200	Monthly Geometric Mean	62-62-600.440(5)(a)2 FAC
		Max	400	90th Percentile	62-62-600.440(5)(a)3 FAC
		Max	800	Single Sample	62-62-600.440(5)(a)4 FAC
pH	s.u.	Min	6.0	Single Sample	62-600.445 FAC
		Max	8.5	Single Sample	62-600.445 FAC
Chlorine, Total Residual (For Disinfection)	mg/L	Min	0.5	Single Sample	62-610.410 & 62-600.440(5)(c) FAC
Nitrogen, Total	mg/L	Max	Report	Single Sample	62-600.740(2)(b)1 FAC
Flow (Concentrate)	MGD	Max	Report	Monthly Average	62-600.700(2)(b) & 62-610.810(5) FAC
		Max	-	Annual Average	62-610.865(8)(b) & 62-610.810(5) FAC
Phosphorus, Total (as P)	mg/L	Max	Report	Single Sample	62-600.740(2)(b)1 FAC
Solids, Total Suspended (Blend)	mg/L	Max	Report	Single Sample	62-610.865(8)(e) FAC
Nitrite plus Nitrate, Total 1 det. (as N)	mg/L	Max	Report	Single Sample	62-600.740(2)(b)1 FAC
pH (Blend)	s.u.	Max	Report	Single Sample	62-610.865(8)(e) FAC
		Min	Report	Single Sample	62-610.865(8)(e) FAC
Specific Conductance (Blend)	umhos/cm	Max	Report	Single Sample	62-610.865(8)(c) FAC
Fluoride, Total (as F) (Blend)	mg/L	Max	Report	Single Sample	62-610.865(8)(e) FAC
Blend Ratio	ratio	Min	-	Single Sample	62-610.865(6)(d) FAC
Sodium Adsorption Ratio (Blend)	ratio	Max	-	Single Sample	62-610.865(8)(e) FAC

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Sodium, Total Recoverable (Blend)	mg/L	Max	Report	Single Sample	62-610.865(8)(e) FAC
Magnesium, Total Recoverable (Blend)	mg/L	Max	Report	Single Sample	62-610.865(8)(e) FAC
Calcium, Total Recoverable (Blend)	mg/L	Max	Report	Single Sample	62-610.865(8)(e) FAC
Chloride (as Cl) (Blend)	mg/L	Max	-	Single Sample	62-610.865(8)(e) FAC
Solids, Total Dissolved (TDS) (Blend)	mg/L	Max	-	Single Sample	62-610.865(8)(e) FAC

Other Limitations and Monitoring Requirements:

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Flow	MGD	Max	0.500	Annual Average	62-600.700(2)(b) FAC
		Max	Report	Monthly Average	62-600.700(2)(b) FAC
		Max	Report	3-Month Rolling Average	62-600.700(2)(b) FAC
Percent Capacity, (TMADF/Permitted Capacity) x 100	percent	Max	Report	-	62-600.405(4) FAC
BOD, Carbonaceous 5 day, 20C (Influent)	mg/L	Max	Report	Single Sample	62-600.660(1) FAC
Solids, Total Suspended (Influent)	mg/L	Max	Report	Single Sample	62-600.660(1) FAC
Monitoring Frequencies and Sample Types	-	-	-	All Parameters	62-600 FAC & 62-699 FAC and/or BPJ of permit writer
Sampling Locations	-	-	-	All Parameters	62-600, 62-610.412, 62-610.463(1), 62-610.568, 62-610.613 FAC and/or BPJ of permit writer

4. IMPAIRMENT STATUS OF RECEIVING WATERS

This facility does not discharge to surface waters. However, the R-001 (restricted access sprayfields) land application system is located in a nutrient-impaired basin (Santa Fe River Basin, Suwannee BMAP, WBID 3513). When effluent is land applied it infiltrates into groundwater and has the potential to deliver nutrient loads to the aquifer and hydrologically connected surface waters. Monitoring for total nitrogen and total phosphorus is included for R-001 in order to provide reasonable assurance that the discharge to ground waters will not cause or contribute to the nutrient impairment in the basin.

From the DEP comprehensive impairment verified list, dated June 21, 2021, and the Suwannee River BMAP that includes the Santa Fe Basin, DO and nutrients are the impairments. The facility will monitor for TN and TP and includes groundwater monitoring. This location is just to the east of the Springs Priority Focus area for Ichetucknee.

5. DISCUSSION OF CHANGES TO PERMIT LIMITATIONS

The wastewater permit for this facility is a new permit.

6. BIOSOLIDS MANAGEMENT REQUIREMENTS

Biosolids generated by this facility may be transferred to City of Lake City WWTF or disposed of in a Class I solid waste landfill.

See the table below for the rationale for the biosolids quantities monitoring requirements.

Parameter	Units	Max/ Min	Limit	Statistical Basis	Rationale
Biosolids Quantity (Landfilled)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Biosolids Quantity (Transferred)	dry tons	Max	Report	Monthly Total	62-640.650(5)(a)1. FAC
Monitoring Frequency		All Parameters			62-640.650(5)(a) FAC

7. GROUNDWATER MONITORING REQUIREMENTS

Groundwater monitoring requirements have been established in accordance with Chapters 62-520, 532, 600, 610, and 620, F.A.C. Monitoring is comprised of four surficial aquifer wells having a quarterly sampling frequency. An extended baseline sampling of each well is to be made prior to initial land application to site R-001.

Additional groundwater monitoring requirements will be established if proposed underground injection well is permitted for the system. Those monitoring requirements will be addressed in a separate UIC permit.

8. PERMIT SCHEDULES

A schedule is not included in the wastewater permit.

9. INDUSTRIAL PRETREATMENT REQUIREMENTS

At this time, the facility is not required to develop an approved industrial pretreatment program. However, the Department reserves the right to require an approved program if future conditions warrant.

10. ADMINISTRATIVE ORDERS (AO) AND CONSENT ORDERS (CO)

This permit is not accompanied by an AO, and the permittee has not entered into a CO with the Department that affects this permit.

11. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

No variances were requested for this facility.

12. THE ADMINISTRATIVE RECORD

The administrative record including application, draft permit, fact sheet, public notice (after release), comments received and additional information is available for public inspection during normal business hours at the location specified in item 14. Copies will be provided at a minimal charge per page.

13. PROPOSED SCHEDULE FOR PERMIT ISSUANCE

Notice of Intent to Issue	December 14, 2021
Publication of Intent	December 20, 2021
Notice of Permit Issuance	January 14, 2022

14. DEP CONTACT

Additional information concerning the permit and proposed schedule for permit issuance may be obtained during normal business hours from:

Jeff Martin, P.E, John Davis, P.G.
Northeast District Office
8800 Baymeadows Way West, Suite 100
Jacksonville, FL 32256-7577
Telephone No.: 904 256 1700

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed submit this report to: Department of Environmental Protection, 8800 Baymeadows Way West, Suite 100, Jacksonville, FL 32256-7577

PERMITTEE NAME: Columbia County Board Commissioners
MAILING ADDRESS: P O Box 1529
Lake City, Florida 32056- 1529

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF
LOCATION: 153 Southeast Tyre Road
Lake City, FL 32025-

COUNTY: Columbia
OFFICE: Northeast District

PERMIT NUMBER: FLAB07233-001-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: RMP-Q
MONITORING GROUP DESCRIPTION: Biosolids Quantity
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Monthly
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Biosolids Quantity (Landfilled)	Sample Measurement										
PARM Code B0008 Mon. Site No.	Permit Requirement		Report (Mo.Total)	dry tons					0	Monthly	Calculated
Biosolids Quantity (Transferred)	Sample Measurement										
PARM Code B0007 Mon. Site No.	Permit Requirement		Report (Mo.Total)	dry tons					0	Monthly	Calculated

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed submit this report to: Department of Environmental Protection, 8800 Baymeadows Way West, Suite 100, Jacksonville, FL 32256-7577

PERMITTEE NAME: Columbia County Board Commissioners
MAILING ADDRESS: P O Box 1529
Lake City, Florida 32056- 1529

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF
LOCATION: 153 Southeast Tyre Road
Lake City, FL 32025-

COUNTY: Columbia
OFFICE: Northeast District

PERMIT NUMBER: FLAB07233-001-DW1P

LIMIT: Final
CLASS SIZE: N/A
MONITORING GROUP NUMBER: RWS-A
MONITORING GROUP DESCRIPTION: Annual Reclaimed Water or Effluent Analysis
RE-SUBMITTED DMR: ☐
NO DISCHARGE FROM SITE: ☐
MONITORING NOT REQUIRED:* ☐
MONITORING PERIOD From: _____ To: _____

REPORT FREQUENCY: Annually
PROGRAM: Domestic

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Antimony, Total Recoverable (GWS = 6)**	Sample Measurement										
PARM Code 01268 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Arsenic, Total Recoverable (GWS = 10)	Sample Measurement										
PARM Code 00978 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Barium, Total Recoverable (GWS = 2,000)	Sample Measurement										
PARM Code 01009 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Beryllium, Total Recoverable (GWS = 4)	Sample Measurement										
PARM Code 00998 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Cadmium, Total Recoverable (GWS = 5)	Sample Measurement										
PARM Code 01113 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Chromium, Total Recoverable (GWS =100)	Sample Measurement										
PARM Code 01118 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC

*THE "MONITORING NOT REQUIRED" CHECKBOX SHOULD BE SELECTED WHEN A CERTIFICATION STATEMENT IN ACCORDANCE WITH SUBSECTION 62-600.680(2), F.A.C., IS SUBMITTED WITH THIS DMR. SEE CERTIFICATION STATEMENT IN COMMENTS SECTION BELOW.
**GROUND WATER STANDARD (GWS) FOR REFERENCE AND REVIEW ONLY.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):
☐ NO NEW NON-DOMESTIC WASTEWATER DISCHARGERS HAVE BEEN ADDED TO THE COLLECTION SYSTEM SINCE THE LAST RECLAIMED WATER OR EFFLUENT ANALYSIS WAS CONDUCTED.
SIGN AND DATE:

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Cyanide, Free (amen. to chlorination)(GWS = 200)	Sample Measurement										
PARM Code 00722 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Fluoride, Total (as F) (GWS = 4.0/2.0)	Sample Measurement										
PARM Code 00951 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Lead, Total Recoverable (GWS = 15)	Sample Measurement										
PARM Code 01114 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Mercury, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 71901 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Nickel, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01074 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Nitrogen, Nitrate, Total (as N) (GWS = 10)	Sample Measurement										
PARM Code 00620 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Nitrogen, Nitrite, Total (as N) (GWS = 1)	Sample Measurement										
PARM Code 00615 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Nitrite plus Nitrate, Total 1 det. (as N)(GWS = 10)	Sample Measurement										
PARM Code 00630 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Selenium, Total Recoverable (GWS =50)	Sample Measurement										
PARM Code 00981 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Sodium, Total Recoverable (GWS = 160)	Sample Measurement										
PARM Code 00923 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Thallium, Total Recoverable (GWS = 2)	Sample Measurement										
PARM Code 00982 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
1,1-dichloroethylene (GWS = 7)	Sample Measurement										
PARM Code 34501 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,1,1-trichloroethane (GWS = 200)	Sample Measurement										
PARM Code 34506 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,1,2-trichloroethane (GWS = 5)	Sample Measurement										
PARM Code 34511 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,2-dichloroethane (GWS = 3)	Sample Measurement										
PARM Code 32103 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,2-dichloropropane (GWS = 5)	Sample Measurement										
PARM Code 34541 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,2,4-trichlorobenzene (GWS = 70)	Sample Measurement										
PARM Code 34551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Benzene (GWS = 1)	Sample Measurement										
PARM Code 34030 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Carbon tetrachloride (GWS = 3)	Sample Measurement										
PARM Code 32102 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Cis-1,2-dichloroethene (GWS = 70)	Sample Measurement										
PARM Code 81686 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dichloromethane (methylene chloride)(GWS = 5)	Sample Measurement										
PARM Code 03821 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Ethylbenzene (GWS = 700)	Sample Measurement										
PARM Code 34371 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Monochlorobenzene (GWS = 100)	Sample Measurement										
PARM Code 34031 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,2-dichlorobenzene (GWS = 600)	Sample Measurement										
PARM Code 34536 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,4-dichlorobenzene (GWS = 75)	Sample Measurement										
PARM Code 34571 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Styrene, Total (GWS = 100)	Sample Measurement										
PARM Code 77128 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Tetrachloroethylene (GWS = 3)	Sample Measurement										
PARM Code 34475 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Toluene (GWS = 1,000)	Sample Measurement										
PARM Code 34010 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
1,2-trans-dichloroethylene (GWS = 100)	Sample Measurement										
PARM Code 34546 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Trichloroethylene (GWS = 3)	Sample Measurement										
PARM Code 39180 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Vinyl chloride (GWS = 1)	Sample Measurement										
PARM Code 39175 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Xylenes (GWS = 10,000)	Sample Measurement										
PARM Code 81551 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
2,3,7,8-tetrachlorodibenzo-p-dioxin(GWS = 3x10^-5)	Sample Measurement										
PARM Code 34675 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
2,4-dichlorophenoxyacetic acid (GWS = 70)	Sample Measurement										
PARM Code 39730 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Silvex (GWS = 50)	Sample Measurement										
PARM Code 39760 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Alachlor (GWS = 2)	Sample Measurement										
PARM Code 39161 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Atrazine (GWS = 3)	Sample Measurement										
PARM Code 39033 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Benzo(a)pyrene (GWS = 0.2)	Sample Measurement										
PARM Code 34247 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Carbofuran (GWS = 40)	Sample Measurement										
PARM Code 81405 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Chlordane (tech mix. and metabolites)(GWS = 2)	Sample Measurement										
PARM Code 39350 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Dalapon (GWS = 200)	Sample Measurement										
PARM Code 38432 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Bis(2-ethylhexyl)adipate (GWS = 400)	Sample Measurement										
PARM Code 77903 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Bis (2-ethylhexyl) phthalate (GWS = 6)	Sample Measurement										
PARM Code 39100 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Dibromochloropropane (DBCP) (GWS = 0.2)	Sample Measurement										
PARM Code 82625 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Dinoseb (GWS = 7)	Sample Measurement										
PARM Code 30191 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Diquat (GWS = 20)	Sample Measurement										
PARM Code 04443 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Endothall (GWS = 100)	Sample Measurement										
PARM Code 38926 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Endrin (GWS = 2)	Sample Measurement										
PARM Code 39390 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Ethylene dibromide (1,2-dibromoethane)(GWS = 0.02)	Sample Measurement										
PARM Code 77651 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	Grab
Glyphosate (GWS = 0.7)	Sample Measurement										
PARM Code 79743 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Heptachlor (GWS = 0.4)	Sample Measurement										
PARM Code 39410 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Heptachlor epoxide (GWS = 0.2)	Sample Measurement										
PARM Code 39420 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Hexachlorobenzene (GWS = 1)	Sample Measurement										
PARM Code 39700 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Hexachlorocyclopentadiene (GWS = 50)	Sample Measurement										
PARM Code 34386 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Gamma BHC (Lindane) (GWS = 0.2)	Sample Measurement										
PARM Code 39782 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Methoxychlor (GWS = 40)	Sample Measurement										
PARM Code 39480 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Oxamyl (vydate) (GWS = 200)	Sample Measurement										
PARM Code 38865 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Pentachlorophenol (GWS = 1)	Sample Measurement										
PARM Code 39032 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Picloram (GWS = 500)	Sample Measurement										
PARM Code 39720 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Polychlorinated Biphenyls (PCBs)(GWS = 0.5)	Sample Measurement										
PARM Code 39516 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Simazine (GWS = 4)	Sample Measurement										
PARM Code 39055 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Toxaphene (GWS = 3)	Sample Measurement										
PARM Code 39400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Trihalomethane, Total by summation(GWS = 0.080)	Sample Measurement										
PARM Code 82080 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	Grab
Radium 226 + Radium 228, Total (GWS = 5)	Sample Measurement										
PARM Code 11503 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L	0	Annually	24-hr FPC
Alpha, Gross Particle Activity (GWS = 15)	Sample Measurement										
PARM Code 80045 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	pCi/L	0	Annually	24-hr FPC
Aluminum, Total Recoverable (GWS = 0.2)	Sample Measurement										
PARM Code 01104 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Chloride (as Cl) (GWS = 250)	Sample Measurement										
PARM Code 00940 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Iron, Total Recoverable (GWS = 0.3)	Sample Measurement										
PARM Code 00980 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Copper, Total Recoverable (GWS = 1,000)	Sample Measurement										
PARM Code 01119 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Manganese, Total Recoverable (GWS = 50)	Sample Measurement										
PARM Code 11123 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC

DISCHARGE MONITORING REPORT - PART A (Continued)

FACILITY: North Florida Mega Industrial Park (NFMIP) WWTF MONITORING GROUP NUMBER: RWS-A PERMIT NUMBER: FLAB07233-001-DW1P

MONITORING PERIOD From: _____ To: _____

Parameter		Quantity or Loading		Units	Quality or Concentration			Units	No. Ex.	Frequency of Analysis	Sample Type
Silver, Total Recoverable (GWS = 100)	Sample Measurement										
PARM Code 01079 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
Sulfate, Total (GWS = 250)	Sample Measurement										
PARM Code 00945 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Zinc, Total Recoverable (GWS = 5,000)	Sample Measurement										
PARM Code 01094 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	ug/L	0	Annually	24-hr FPC
pH (GWS = 6.5-8.5)	Sample Measurement										
PARM Code 00400 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	s.u.	0	Annually	Grab
Solids, Total Dissolved (TDS) (GWS = 500)	Sample Measurement										
PARM Code 70295 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC
Foaming Agents (GWS = 0.5)	Sample Measurement										
PARM Code 01288 P Mon. Site No. RWS-A	Permit Requirement						Report (Max.)	mg/L	0	Annually	24-hr FPC

DAILY SAMPLE RESULTS - PART B

Permit Number: FLAB07233-001-DW1P Facility: North Florida Mega Industrial Park (NFMIP) WWTF
Monitoring Period From: _____ To: _____

	BOD, Carbonaceous 5 day, 20C (Influent) mg/L	Flow MGD	Nitrite plus Nitrate, Total 1 det. (as N) mg/L	Nitrogen, Total mg/L	Phosphorus, Total (as P) mg/L	Solids, Total Suspended (Influent) mg/L					
Code	80082	50050	00630	00600	00665	00530					
Mon. Site	INF-1	INF-1	EFA-1	EFA-1	EFA-1	INF-1					
1											
2											
3											
4											
5											
6											
7											
8											
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25											
26											
27											
28											
29											
30											
31											
Total											
Mo. Avg.											

PLANT STAFFING:

Day Shift Operator Class: _____ Certificate No: _____ Name: _____

Evening Shift Operator Class: _____ Certificate No: _____ Name: _____

Night Shift Operator Class: _____ Certificate No: _____ Name: _____

Lead Operator Class: _____ Certificate No: _____ Name: _____

GROUNDWATER MONITORING REPORT - PART D

Facility Name: North Florida Mega Industrial Park (NFMIP) WWTF
Permit Number: FLAB07233-001-DW1P
County: Columbia
Office: Northeast District

Monitoring Well ID: MWB-1AS
Well Type: Background
Description: West of sprayfield road entrance
Report Frequency: Quarterly
Program: Domestic
Re-submitted DMR: ☐

Monitoring Period From: _____ To: _____

Date Sample Obtained: _____

Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		Report	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		Report	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		Report	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		Report	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		Report	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		Report	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		Report	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		Report	#/100mL	Grab	Quarterly				
pH	00400		Report	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		Report	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: North Florida Mega Industrial Park (NFMIP) WWTF
Permit Number: FLAB07233-001-DW1P
County: Columbia
Office: Northeast District

Monitoring Well ID: MWC-3S
Well Type: Compliance
Description: Southern limit of west sprayfield
Report Frequency: Quarterly
Program: Domestic
Re-submitted DMR: ☐

Monitoring Period From: _____ To: _____
Date Sample Obtained: _____
Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		100	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

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NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: North Florida Mega Industrial Park (NFMIP) WWTF
Permit Number: FLAB07233-001-DW1P
County: Columbia
Office: Northeast District

Monitoring Well ID: MWC-4S
Well Type: Compliance
Description: Eastern margin of east sprayfield
Report Frequency: Quarterly
Program: Domestic
Re-submitted DMR: ☐

Monitoring Period From: _____ To: _____
Date Sample Obtained: _____
Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		10	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		100	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100mL	Grab	Quarterly				
pH	00400		6.5-8.5	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		250	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

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NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUNDWATER MONITORING REPORT - PART D

Facility Name: North Florida Mega Industrial Park (NFMIP) WWTF
Permit Number: FLAB07233-001-DW1P
County: Columbia
Office: Northeast District

Monitoring Well ID: MWI-2S
Well Type: Intermediate
Description: Central area of west sprayfield
Report Frequency: Quarterly
Program: Domestic
Re-submitted DMR: ☐

Monitoring Period From: _____ To: _____
Date Sample Obtained: _____
Time Sample Obtained: _____

Was the well purged before sampling? ___Yes ___ No

Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Frequency of Analysis	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered (L/F/N)
Water Level Relative to NGVD	82545		Report	ft	In Situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		Report	mg/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		Report	mg/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		Report	ug/L	Grab	Quarterly				
Chloride (as Cl)	00940		Report	mg/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		Report	ug/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		Report	ug/L	Grab	Quarterly				
Lead, Total Recoverable	01114		Report	ug/L	Grab	Quarterly				
Coliform, Fecal	74055		Report	#/100mL	Grab	Quarterly				
pH	00400		Report	s.u.	In Situ	Quarterly				
Sulfate, Total	00945		Report	mg/L	Grab	Quarterly				
Turbidity	00070		Report	NTU	Grab	Quarterly				

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME/TITLE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	TELEPHONE NO	DATE (mm/dd/yyyy)

COMMENTS AND EXPLANATION (Reference all attachments here):

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

Read these instructions before completing the DMR. Hard copies and/or electronic copies of the required parts of the DMR were provided with the permit. All required information shall be completed in full and typed or printed in ink. A signed, original DMR shall be mailed to the address printed on the DMR by the 28th of the month following the monitoring period. Facilities who submit their DMR(s) electronically through eDMR do not need to submit a hardcopy DMR. The DMR shall not be submitted before the end of the monitoring period.

The DMR consists of three parts--A, B, and D--all of which may or may not be applicable to every facility. Facilities may have one or more Part A's for reporting effluent or reclaimed water data. All domestic wastewater facilities will have a Part B for reporting daily sample results. Part D is used for reporting ground water monitoring well data.

When results are not available, the following codes should be used on parts A and D of the DMR and an explanation provided where appropriate. Note: Codes used on Part B for raw data are different.

CODE	DESCRIPTION/INSTRUCTIONS
ANC	Analysis not conducted.
DRY	Dry Well
FLD	Flood disaster.
IFS	Insufficient flow for sampling.
LS	Lost sample.
MNR	Monitoring not required this period.

CODE	DESCRIPTION/INSTRUCTIONS
NOD	No discharge from/to site.
OPS	Operations were shutdown so no sample could be taken.
OTH	Other. Please enter an explanation of why monitoring data were not available.
SEF	Sampling equipment failure.

When reporting analytical results that fall below a laboratory's reported method detection limits or practical quantification limits, the following instructions should be used, unless indicated otherwise in the permit or on the DMR:

1. Results greater than or equal to the PQL shall be reported as the measured quantity.
2. Results less than the PQL and greater than or equal to the MDL shall be reported as the laboratory's MDL value. These values shall be deemed equal to the MDL when necessary to calculate an average for that parameter and when determining compliance with permit limits.
3. Results less than the MDL shall be reported by entering a less than sign ("<") followed by the laboratory's MDL value, e.g. < 0.001. A value of one-half the MDL or one-half the effluent limit, whichever is lower, shall be used for that sample when necessary to calculate an average for that parameter. Values less than the MDL are considered to demonstrate compliance with an effluent limitation.

PART A -DISCHARGE MONITORING REPORT (DMR)

Part A of the DMR is comprised of one or more sections, each having its own header information. Facility information is preprinted in the header as well as the monitoring group number, whether the limits and monitoring requirements are interim or final, and the required submittal frequency (e.g. monthly, annually, quarterly, etc.). Submit Part A based on the required reporting frequency in the header and the instructions shown in the permit. The following should be completed by the permittee or authorized representative:

Resubmitted DMR: Check this box if this DMR is being re-submitted because there was information missing from or information that needed correction on a previously submitted DMR. The information that is being revised should be clearly noted on the re-submitted DMR (e.g. highlight, circle, etc.)
No Discharge From Site: Check this box if no discharge occurs and, as a result, there are no data or codes to be entered for all of the parameters on the DMR for the entire monitoring group number; however, if the monitoring group includes other monitoring locations (e.g., influent sampling), the "NOD" code should be used to individually denote those parameters for which there was no discharge.
Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Sample Measurement: Before filling in sample measurements in the table, check to see that the data collected correspond to the limit indicated on the DMR (i.e. interim or final) and that the data correspond to the monitoring group number in the header. Enter the data or calculated results for each parameter on this row in the non-shaded area above the limit. Be sure the result being entered corresponds to the appropriate statistical base code (e.g. annual average, monthly average, single sample maximum, etc.) and units. Data qualifier codes are not to be reported on Part A.
No. Ex.: Enter the number of sample measurements during the monitoring period that exceeded the permit limit for each parameter in the non-shaded area. If none, enter zero.
Frequency of Analysis: The shaded areas in this column contain the minimum number of times the measurement is required to be made according to the permit. Enter the actual number of times the measurement was made in the space above the shaded area.
Sample Type: The shaded areas in this column contain the type of sample (e.g. grab, composite, continuous) required by the permit. Enter the actual sample type that was taken in the space above the shaded area.
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comment and Explanation of Any Violations: Use this area to explain any exceedances, any upset or by-pass events, or other items which require explanation. If more space is needed, reference all attachments in this area.

PART B - DAILY SAMPLE RESULTS

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data qualifier codes should be used and an explanation provided where appropriate.

CODE	DESCRIPTION/INSTRUCTIONS
<	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
J	Estimated value, value not accurate.
Q	Sample held beyond the actual holding time.
Y	Laboratory analysis was from an unpreserved or improperly preserved sample.

To calculate the monthly average, add each reported value to get a total. For flow, divide this total by the number of days in the month. For all other parameters, divide the total by the number of observations.
Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed.
Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.
Time Sample Obtained: Enter the time the sample was taken.
Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that. Data qualifier codes are not to be reported on Part D.
Detection Limits: Record the detection limits of the analytical methods used.
Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.
Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)
Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N).
Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.
Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD).
Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. The average flow rate can be calculated based on two measurements; one made at the start and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.
Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.
No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.
$CBOD_5$: Enter the average $CBOD_5$ of the reclaimed water discharged during the period shown in duration of discharge.
TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.
Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.
Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall year. The cumulative rainfall for the average rainfall year is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.
No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.
Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

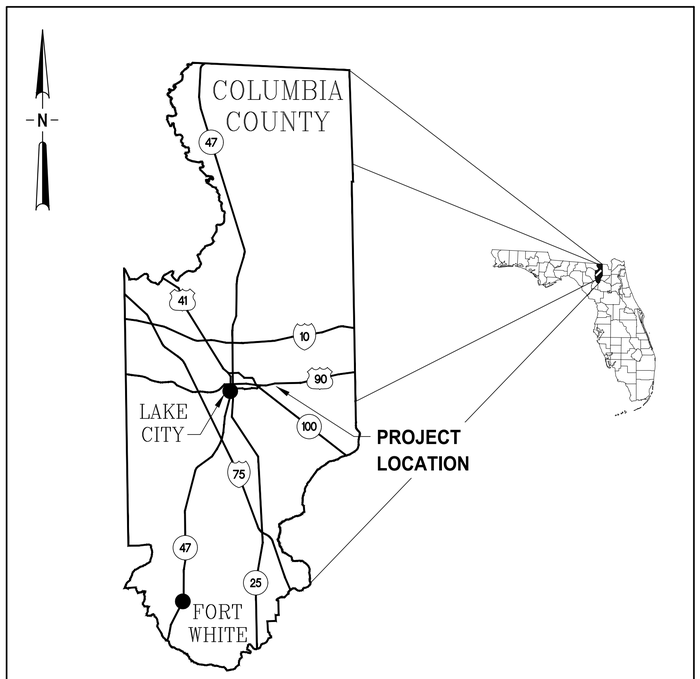
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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT

COLUMBIA COUNTY, FLORIDA



SITE VICINITY MAP

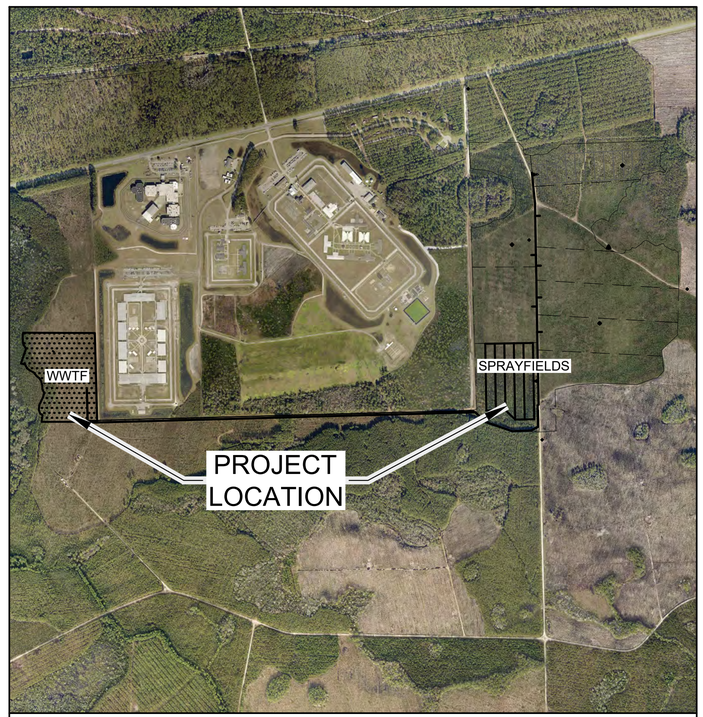
COLUMBIA COUNTY
FLORIDA'S GATEWAY SINCE 1832

COMMISSIONERS

RON WILLIAMS	DISTRICT 1
ROCKY FORD	DISTRICT 2
ROBBY HOLLINGSWORTH (CHAIRMAN)	DISTRICT 3
TOBY WITT	DISTRICT 4
TIM MURPHY	DISTRICT 5

PREPARED BY:

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821



PROJECT LOCATION
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LAKE CITY, FLORIDA 32025

THOMAS W. FRIEDRICH
LICENSE
No. 61281
STATE OF FLORIDA
PROFESSIONAL ENGINEER

Thomas W. Friedrich, State of Florida, License No. 61281

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PROJECT No. 03780-001-01

APRIL 2022

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M35	MECHANICAL DETAILS
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*	I06	MECHANICAL SCREENS
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	ARCHITECTURAL	
	A1	OPERATIONS BUILDING PLAN

* ELECTRICAL AND INSTRUMENTATION DRAWINGS WITH UPDATED DRAWING INDEX TO BE ISSUED VIA ADDENDUM

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LTR.	DATE	REVISIONS	BY	APPRD.

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DRAWN JKRAMER
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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

DRAWING INDEX

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
DWG NO: G2

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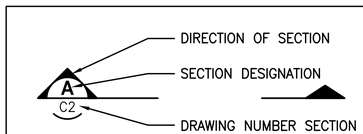
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STANDARD ABBREVIATIONS

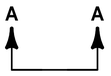
&	AND
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
AC	ALTERNATING CURRENT
ACI	AMERICAN CONCRETE INSTITUTE
AFF	ABOVE FINISHED FLOOR
ALUM	ALUMINUM
AMPS	AMPERES
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
ARV	AIR RELEASE VALVE
ASD	ADJUSTABLE SPEED DRIVE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AWG	AMERICAN WIRE GAUGE
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
BE	BURIED ELECTRICAL
BF	BLIND FLANGE
BFP	BACKFLOW PREVENTER
BFV	BUTTERFLY VALVE
BKR	BREAKER
BLDG	BUILDING
BLVD	BOULEVARD
BV	BALL VALVE
C	CONDUIT, CONDUCTOR, CLOSE
C/L, CL	CENTERLINE
CB	CIRCUIT BREAKER
CFWE	CABLE FURNISHED WITH EQUIPMENT
CI	CAST IRON
CLF	CHAIN LINK FENCE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CONSTR	CONSTRUCTION
CORP	CORPORATION
CP	CONTROL PANEL
CT	CURRENT TRANSFORMER, CABLE TRAY CONTACTOR
CV	CHECK VALVE
DB	DUCT BANK
DC	DIRECT CURRENT
DET	DETAIL
DI	DUCTILE IRON
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DIPS	DUCTILE IRON PIPE SIZE
DIV	DIVISION
DR	DIMENSION RATIO
DR	DRAIN OR DRIVE
DWG	DRAWING
E	EAST
EA	EACH
EL, ELEV	ELEVATION
ELB	ELBOW
ELEC	ELECTRICAL
EOP	EDGE OF PAVEMENT
EQ	EQUAL
ETC	ETCETERA
EW	EACH WAY
EXIST	EXISTING
FBC	FLORIDA BUILDING CODE
F, FU	FUSE
FAB	FABRICATED
FAC	FLORIDA ADMINISTRATIVE CODE
FCA	FLANGED COUPLING ADAPTER
FDEP	FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
FDOT	FLORIDA DEPARTMENT OF TRANSPORTATION
FF	FINISHED FLOOR
FIG	FIGURE
FIN	FINISHED
FJ	FLANGED JOINT
FLG	FLANGE(D)
FREQ	FREQUENCY
FRP	FIBER REINFORCED PLASTIC
FS	FLORIDA STATUTES, FAR SIDE, FLOW SWITCH
FT	FOOT
G	GROUND
GAL	GALLON
GALV	GALVANIZED
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERUPTER
GND	GROUND
GPM	GALLONS PER MINUTE
GR	GRADE
GRTG	GRATING
GS	GALVANIZED STEEL
GSP	GALVANIZED STEEL PIPE
GST	GROUND STORAGE TANK
GV	GATE VALVE
H	HIGH
HD	HAND
HDD	HORIZONTAL DIRECTIONAL DRILL
HDNS	HARDNESS
HDPE	HIGH DENSITY POLYETHYLENE
HHWL	HIGH HIGH WATER LEVEL
HK	HOOK
HOA	HAND–OFF–AUTO
HOR	HAND–OFF–REMOTE
HORIZ	HORIZONTAL
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HR	HANDRAIL
HSPS	HIGH SERVICE PUMP STATION
HT	HEIGHT
HWL	HIGH WATER LEVEL
I&C	INSTRUMENTATION AND CONTROL
IC	INTERRUPTING CAPACITY
ID	INSIDE DIAMETER
ID	IDENTIFICATION
IE	INVERT ELEVATION
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
IF	INSULATED FLANGE
IJ	ISOLATION JOINT
INC	INCORPORATED
IPS	IRON PIPE SIZE
J, JB	JUNCTION BOX
JT	JOINT
KA	KILOAMPERES
KB	KNEE BRACE
KCMIL	THOUSAND CIRCULAR MILS
KV	KILOVOLT
KVA	KILOVOLT AMPERES
KW	KILOWATTS
KWH	KILOWATT HOUR
L	LOWER
LB, LBS	POUND(S)
LE	LEVEL ELEMENT
LEL	LOWER EXPLOSIVE LIMIT
LF	LINEAR FEET
LG	LONG
LIT	LEVEL INDICATING TRANSMITTER
LIU	LIGHT INTERFACE UNIT
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LLWL	LOW LOW WATER LEVEL
LOS	LOCKOUT STOP
LR	LONG RADIUS, LOCAL–REMOTE
LS	LIFT STATION
LSIG	LONG SHORT INSTANTANEOUS GROUND
LWL	LOW WATER LEVEL
M	MAGNETIC CONTACTOR COIL, MOTOR, MANUAL
M/F	MALE/FEMALE
MAX	MAXIMUM
MC	MODULATE–CLOSE
MCC	MOTOR CONTROL CENTER
MCJ	MASONRY CONTROL JOINT
MECH	MECHANICAL
MES	MITERED END SECTION
MFR	MANUFACTURER
MG	MILLION GALLON(S)
MH M/H	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MNPT	MALE NATIONAL PIPE THREAD
MO	MOTOR OPERATOR
MOT	MAINTENANCE OF TRAFFIC
MP	METERING PUMP
MPH	MILES PER HOUR
MS	MOTOR STARTER
MSC	MANUFACTURER SUPPLIED CABLE
MT, MTD	MOUNT(ED)
MTL	METAL
MV	MEDIUM VOLTAGE
N	NORTH(ING), NEUTRAL, NORMAL
N/A	NOT APPLICABLE
NAD	NORTH AMERICAN DATUM
NAVD	NORTH AMERICAN VERTICAL DATUM
NC	NORMALLY CLOSED
NE	NORTH EAST
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NEUT	NEUTRAL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
No.	NUMBER
NO	NORMALLY OPEN
NOM	NOMINAL
NPDES	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
NPT	NATIONAL PIPE THREAD
NRS	NONRISING STEM
NS	NEAR SIDE
NSF	NATIONAL SANITATION FOUNDATION
NTS	NOT TO SCALE
NW	NORTH WEST
OC	ON CENTER(S), OPEN–CLOSE(D)
OCA	OPEN–CLOSE–AUTO
OCR	OPEN–CLOSE–REMOTE
OD	OUTSIDE DIAMETER
OFL	OVERFLOW
OO	ON–OFF
OOA	ON–OFF–AUTO
OOR	ON–OFF–REMOTE
OPP	OPPOSITE
OS&Y	OUTSIDE STEM AND YOKE
OSC	OPEN–STOP–CLOSE
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
P&ID	PIPING AND INSTRUMENTATION DIAGRAM
P/L	PROPERTY LINE
PB	PULL BOX
PCCP	PRESTRESSED CONCRETE CYLINDER PIPE
PCV	PRESSURE CONTROL VALVE
PE	PLAIN END, POLYETHYLENE
PET	POLYETHYLENE TUBING
PF	POWER FACTOR
pH	HYDROGEN ION CONCENTRATION
PH	PHASE
PI	PRESSURE INDICATOR/GAUGE
PID	PROPORTIONAL INTEGRAL DERIVATIVE
PIT	PRESSURE INDICATING TRANSMITTER
PIV	POST INDICATOR VALVE
PL	PLATE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLCS	PLACES
POC	POINT OF CONNECTION
POE	POINT OF ENTRY
POJ	PUSH ON JOINT
PP	POWER POLE
PPE	PERSONAL PROTECTIVE EQUIPMENT
PRV	PRESSURE REDUCING VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSID	POUNDS PER SQUARE INCH DIFFERENTIAL
PSIG	POUNDS PER SQUARE INCH GAUGE
PSV	PRESSURE SUSTAINING VALVE
PT	PRESSURE TREATED, POTENTIAL TRANSFORMER
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PWR	POWER
R	RADIUS
R/W, ROW	RIGHT–OF–WAY
RCP	REINFORCED CONCRETE PIPE
RCPT	RECEPTACLE
RD	ROAD
RED	REDUCER
REF	REFERENCE
REINF	REINFORCEMENT, REINFORCING
REQ, REQ'D	REQUIRED
RGS	RIGID GALVANIZED STEEL
RJ	RESTRAINED JOINT
RM	REMOTE MULTIPLEXING MODULE
RMS	ROOT MEAN SQUARE
RPZ	REDUCED PRESSURE ZONE
RT	RIGHT
RTU	REMOTE TELEMETRY UNIT
S	SOUTH
SARV	SURGE ANTICIPATOR RELIEF VALVE
SBC	STANDARD BUILDING CODE
SCH	SCHEDULE
SCJ	SAW CUT JOINT
SDI	STEEL DECK INSTITUTE
SE	SOUTH EAST
SEC	SECOND
SF	SLOWER–FASTER
SHEC	SHOULDERED–END COUPLING
SHT	SHEET
SIM	SIMILAR
SJI	STEEL JOINT INSTITUTE
SM	STATIC MIXER
SP	SPACING, SPACED
SPD	SURGE PROTECTIVE DEVICE
SQ	SQUARE
SR	STATE ROAD, SURGE RELIEF
SRV	SURGE RELIEF VALVE
SS	START–STOP
SS, SST	STAINLESS STEEL
SSC	SUPERVISORY SET POINT CONTROL
SSRV	SOLID STATE REDUCED VOLTAGE
ST	SHUNT TRIP
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STS	STORMWATER SEWER
SW	SOUTH WEST, SWITCH
SWD	SIDE WATER DEPTH
SWJ	SOLVENT WELD JOINT
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
SY	SQUARE YARD
T, THK	THICK
T/	TOP OF
T/B,T&B	TOP AND BOTTOM
TBM	TEMPORARY BENCHMARK
TEMP	TEMPERATURE
TGS	THREADED GALVANIZED STEEL
TGSP	THREADED GALVANIZED STEEL PIPE
TH	TOTAL HEAD
THD	THREADED
TJB	TERMINAL JUNCTION BOX
TK	TANK
TOC	TOP OF CONCRETE
TOS	TOP OF STRCTURE
TOSJ	TOP OF STEEL JOIST
TOW	TOP OF WALL
TS	TUBULAR STEEL
TSF	THICKENED SLAB FOOTING
TSP	TWISTED SHIELDED PAIR
TURB	TURBIDITY
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITER'S LABORATORIES
ULC	ULTRASONIC LEVEL CONTROLLER
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTAGE, VOLTS
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VH	VAPOR HEATER
VIB	VIBRATION
VIF	VERIFY IN FIELD
VP	VAPORIZER
W	WIDE, WATT
W/	WITH
W/O	WITHOUT
WCJ	WALL CONTROL JOINT
WF	WALL FOOTING
WGT	WEIGHT
WP	WORK POINT, WEATHERPROOF
WSE, WSEL	WATER SURFACE ELEVATION
WT	WEIGHT
WV	WATER VALVE
WWF	WELDED WIRE FABRIC
XFMR	TRANSFORMER
XS	EXTRA STRONG

CUSTOM ABBREVIATIONS

A/L	ACCESS LID
RCW	RECLAIMED WATER
SWFWMD	SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
NFMIP	NORTH FLORIDA MEGA INDUSTRIAL PARK

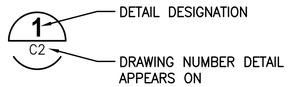


SECTION DESIGNATION



INDICATES ONE OR MORE SECTIONS CUT SHOWN ON THE SAME DETAIL

SECTION DESIGNATION



DETAIL DESIGNATION

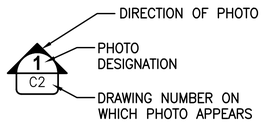


PHOTO DESIGNATION

NOTES:

1. SEE LEGENDS AND PIPE SCHEDULE FOR ADDITIONAL ABBREVIATIONS.
2. NOT ALL ABBREVIATIONS MAY BE USED FOR THIS PROJECT.

BID SUBMITTAL

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

ABBREVIATIONS & DESIGNATIONS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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MECHANICAL LEGEND

CIVIL LEGEND

- CONTOURS (90)
- CENTERLINE
- DEMO HATCH
- SILT FENCE (SF SF)
- FIBER OPTIC CONDUIT (FOC FOC)
- FORCE MAIN (FM)
- SANITARY GRAVITY MAIN (SAN)
- WATER MAIN (W W W)
- SANITARY MANHOLE
- SPOT ELEVATION (+100.00)
- COORDINATE POINT
- CONCRETE
- COMPACTED SOIL
- GRAVEL
- CONCRETE SIDEWALK RESTORATION
- ASPHALT RESTORATION

NOTE:
EXISTING PIPE, EQUIPMENT, AND FEATURES ARE SHOWN IN THE DRAWINGS AS LIGHT–LINED AND/OR SCREENED. PROPOSED PIPE, EQUIPMENT, AND FEATURES ARE SHOWN IN THE DRAWINGS AS HEAVY–LINED. ABOVE GRADE PIPE, EQUIPMENT, AND FEATURES ARE SHOWN IN DRAWINGS AS SOLID–LINED. BELOW GRADE PIPE, EQUIPMENT, AND FEATURES ARE SHOWN IN DRAWINGS AS DASHED–LINED. SEE BELOW EXAMPLES:

- EXISTING PIPE (ABOVE GRADE)
- PROPOSED PIPE (ABOVE GRADE)
- PROPOSED PIPE (BELOW GRADE)
- EXISTING CONTOUR (90)
- FIRE HYDRANT

DOUBLE LINE	SINGLE LINE	
		PIPE
		WELDED PIPE
		FLANGED JOINT
		MECHANICAL JOINT OR PUSH–ON JOINT
		FLEXIBLE COUPLING ADAPTER
		EXPANSION JOINT
		HUB & SPIGOT JOINT
		BALL JOINT
		FLANGED COUPLING ADAPTER W/ THRUST TIES
		FLEXIBLE COUPLING WITH THRUST TIES
		BLIND FLANGE
		ELBOW UP
		ELBOW DOWN
		TEE UP
		TEE DOWN
		FEMALE QUICK DISCONNECT FITTING
		MALE QUICK DISCONNECT FITTING

PIPING SYMBOLS

DOUBLE LINE	SINGLE LINE	
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		CAP
		ANCHOR
		WYE
		TEE
		CROSS
		ELBOW, 90 DEGREE
		ELBOW, 45 DEGREE
		ELBOW, 22.5 DEGREE
		ABANDON IN PLACE
		DEMOLISH (AND REMOVE)

VALVE SYMBOLS

- GATE
- BUTTERFLY
- BALL
- CHECK
- PLUG
- AIR RELEASE AND/ OR VACUUM RELIEF
- REGULATED SIDE
- HYDRAULIC CONTROL VALVE

ACTUATOR SYMBOLS

- M / XX — ELECTRIC MOTOR
- EH / XX — ELECTROHYDRAULIC
- P / XX — PNEUMATIC
- H / XX — HYDRAULIC
- S — SOLENOID
- MANUAL

NOTE:
ON LOSS OF PRIMARY POWER (PNEUMATIC, ELECTRICAL OR HYDRAULIC)
XX: FO = FAIL OPEN
FC = FAIL CLOSED
FLP = FAIL TO LAST POSITION

PIPE SUPPORT SYMBOLS

- ▲ U–BOLT PIPE SUPPORT
- △ FLANGED PIPE SUPPORT

PIPING DESIGNATION

EXAMPLE:
16" RCW
16" RCW
PIPE USE – SEE PROCESS PIPE FLOW STREAM IDENTIFICATION AND SCHEDULE
NOMINAL PIPE DIAMETER

VALVE DESIGNATION

V100	AIR RELEASE VALVE
V200	BALL VALVE
V300	BUTTERFLY VALVE
V400	CHECK VALVE
V500	DIAPHRAGM VALVE
V600	GATE VALVE
V700	GLOBE OR ANGLE VALVE
V800	PINCH VALVE
V900	PLUG VALVE
V1000	SOLENOID VALVE
V1100	SPECIAL TYPE OF VALVE

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DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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LEGENDS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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PIPE SCHEDULE

ABBREVIATION	FLOW STREAM IDENTIFICATION	PIPE/DUCT MATERIAL	SCHEDULE/CLASS	PIPE MATERIAL ABBREV	SPECIFICATION NUMBER	PIPE LINING	NORMAL MAX OPERATING PRESSURE (PSIG)	FIELD TEST PRESSURE (PSIG)	EXPOSED PIPE PAINT SYSTEM	COLOR CODE *	SPECIFIC NOTES	RESTRAINT SYSTEM NOTES
CF–1	CARBON FEED	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	40	100		ORANGE		
DR–1	DRAIN	POLYVINYL CHLORIDE	SDR 35	PVC	15250	N/A	5	5		LT BROWN		(2)
DR–2	DRAIN	HIGH DENSITY POLYETHYLENE	DR 17	HDPE	15146	N/A	5	5		LT BROWN		(2)
DR–3	DRAIN	DUCTILE IRON	PC 150	DI	15062	EPOXY	5	5		LT BROWN		(2)
DS–1	DIGESTED SLUDGE	DUCTILE IRON	PC 250	DI	15155	EPOXY	15	100		BROWN		(2)
EQ–1	EQ EFFLUENT	DUCTILE IRON	PC 250	DI	15155	EPOXY	15	100		BROWN		(2)
IN–1	INFLUENT–FORCE MAIN	POLYVINYL CHLORIDE	C–900	PVC	15250	N/A	50	100	2, 51	BROWN		(2)
IN–2	INFLUENT	HIGH DENSITY POLYETHYLENE	DR 21	HDPE	15146	N/A	50	100	2	BROWN		(2)
IN–3	INFLUENT	DUCTILE IRON	PC 250	DI	15155	EPOXY	50	100	2	BROWN		(2)
IR–1	INTERNAL RECYCLE	DUCTILE IRON	PC 250	DI	15155	EPOXY	15	100		BROWN		(2)
LP–1	LEACHATE	POLYVINYL CHLORIDE	C–900	PVC	15250	N/A	50	100		GREEN		(2)
LP–2	LEACHATE	DUCTILE IRON	PC 250	DI	15155	EPOXY	50	100		GREEN		(2)
LP–3	LEACHATE	HIGH DENSITY POLYETHYLENE TUBING	DR 21	HDPE	15146	N/A	15	100		GREEN	DIPS	(2)
LPA–1	LOW PRESSURE AIR	STAINLESS STEEL	5 S	SST	15276	N/A	15	30		N/A		(2)
NaOCl–1	SODIUM HYPOCHLORITE FEED	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	80	100		YELLOW		(2)
PW–1	POTABLE WATER	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	50	100	6	DARK BLUE	(C)	(2)
PW–2	POTABLE WATER–FIRE	POLYVINYL CHLORIDE	SCH 80	PVC	15291	N/A	80	120	6	DARK BLUE	(C)	(2)
PSD–1	PLANT SITE DRAIN FM	DUCTILE IRON	PC 250	DI	15155	EPOXY	50	100		LT GRAY		(2)
RCW–1	RECLAIMED WATER	POLYVINYL CHLORIDE	C–900	C–900	15155	N/A	70	150		PURPLE	(D)	(2)
RCW–2	RECLAIMED WATER	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	70	150		PURPLE	(D)	(2)
RCW–3	RECLAIMED WATER / SPRAYFIELD	HIGH DENSITY POLYETHYLENE	DR 17–21	HDPE	15146	N/A	50	100	2	PURPLE	(D) (E)	
SA–1	CHLORINE SAMPLE LINE	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	40	100		YELLOW		(2)
SA–2	INFLUENT SAMPLE LINE	POLYVINYL CHLORIDE	SCH 80	PVC	15250	N/A	40	100		GREEN		(2)
SE–1	SECONDARY EFFLUENT	DUCTILE IRON	PC 250	DI	15155	EPOXY	15	50		LT GRAY		(2)
SE–2	SECONDARY EFFLUENT	POLYVINYL CHLORIDE	C–900	PVC	15291	N/A	15	50	51	LT GRAY		(2)

GENERAL NOTES:

1. COAT EXTERIOR OF BURIED PIPE PER SPECIFICATIONS.
2. TEST LINES PER PROCEDURE IN SECTION 15144 UNLESS SPECIFIED AND/OR NOTED OTHERWISE.
3. PAINT SYSTEM PRESENTED IN SECTION 09900.
4. ALL HDPE PIPING SHALL BE IN ACCORDANCE WITH SPECIFICATION 15146, UNLESS NOTED OTHERWISE.
5. FLOW STREAM IDENTIFICATION SHALL BE PAINTED ON ALL ABOVE GRADE PIPING AS SPECIFIED.
6. FIELD TEST PRESSURE SHALL BE EITHER 1.5 MAX PRESSURE OR 100 PSI PER SPECIFICATIONS, SECTION 15.144–1.06 A.
7. LABEL ALL PIPING PER SECTION 15075.

RESTRAINT SYSTEM NOTES:
(1) RESTRAIN AT FITTINGS AND VALVES.
(2) RESTRAIN ALL JOINTS, FITTINGS, AND VALVES, ETC. INCLUDING NEW TO EXISTING.
(3) RESTRAIN JOINTS, FITTINGS, VALVES, ETC. IN ACCORDANCE WITH THRUST RESTRAIN SCHEDULE IN THE DETAIL DRAWINGS.

SPECIFIC NOTES:
(A) HYDROSTATIC PRESSURE TEST.
(B) PNEUMATIC PRESSURE TEST.
(C) DISINFECTION PIPING PER SPEC.
(D) PANTONE PURPLE
(E) 12" HDPE IS INSTALLED BELOW GRADE.

* SPECIFIC COLORS TO MATCH SPECIFICATIONS.

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PIPE SCHEDULE

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GENERAL NOTES

REFERENCED DATA

1. TOPOGRAPHIC SURVEY PERFORMED BY MOORE BASS CONSULTING, A FLORIDA LICENSED PROFESSIONAL LAND SURVEYOR, DATED 04/20/2020.
2. ALL ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD 88) AND REFERENCED TO COUNTY BENCHMARK. THE HORIZONTAL DATUM IS BASED ON STATE PLANE WEST ZONE, NAD83 (1990), 3RD ORDER.
3. THE SURVEY INFORMATION CONTAINED HEREIN WAS OBTAINED FOR DESIGN PURPOSES AND MAY NOT BE AN ADEQUATE REPRESENTATION OF ACTUAL CONDITIONS FOR PROJECT CONSTRUCTION. EXISTING CONTOURS SHOWN REPRESENT INTERPOLATIONS/EXTRAPOLATIONS FROM THE BEST AVAILABLE SURVEY DATA. ALL RISKS RESULTING FROM THE USE OR INTERPRETATION OF THE SURVEY DATA SHOWN SHALL BE BORNE BY THE CONTRACTOR.
4. GEOTECHNICAL INVESTIGATION AND RECOMMENDATIONS PERFORMED BY GSE ENGINEERING & CONSULTING, INC. REFER TO REPORTS DATED DECEMBER 2021.
5. LAND LEASE FOR SPRAYFIELD PROPERTY IN ACCORDANCE WITH WEYERHAEUSER AGREEMENT DATED DECEMBER 2021.

GENERAL

6. THE CONTRACTOR SHALL COMPLY WITH ALL CONDITIONS AND REQUIREMENTS OF ALL PERMITS (FDEP, SWFWMD, ETC) OBTAINED FOR THIS PROJECT.
7. CONSTRUCTION MATERIALS QUALITY AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE PROJECT AND THE REGULATIONS AND ORDINANCES OF THE VARIOUS GOVERNMENTAL AGENCIES HAVING JURISDICTION OVER THE WORK.
8. THE CONTRACTOR IS ADVISED NOT TO SCALE FROM DRAWINGS BUT TO FIELD VERIFY ALL DIMENSIONS. THE DIMENSIONS OF SPECIFIED AND FURNISHED PRODUCTS AND MATERIALS TAKE PRECEDENCE OVER DIMENSIONS INDICATED ON THE DRAWINGS. IF SIGNIFICANT DEVIATIONS OCCUR, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEAST 72 HOURS PRIOR TO CONSTRUCTION FOR A DETERMINATION AND RESOLUTION.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DOCUMENTING AND MAINTAINING AS-BUILT INFORMATION WHICH SHALL BE RECORDED AS CONSTRUCTION PROGRESSES OR AT THE COMPLETION OF APPROPRIATE CONSTRUCTION INTERVALS AND SHALL BE RESPONSIBLE FOR PROVIDING CERTIFIED AS-BUILT RECORD DRAWINGS TO THE OWNER AND ENGINEER FOR THE PURPOSE OF CERTIFICATION TO JURISDICTIONAL AGENCIES AS REQUIRED. ALL AS-BUILT DATA SHALL BE COLLECTED BY A STATE OF FLORIDA PROFESSIONAL LAND SURVEYOR WHOSE SERVICES ARE ENGAGED BY THE CONTRACTOR. ALL SURVEY COSTS WILL BE THE CONTRACTOR'S RESPONSIBILITY.

CONSTRUCTION LAYOUT/LIMITS OF CONSTRUCTION

10. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF A FLORIDA LICENSED LAND SURVEYOR FOR LAYOUT. PROOF OF LICENSE SHALL BE SUBMITTED TO THE ENGINEER BEFORE BEGINNING LAYOUT.
11. NO DISTURBANCE SHALL BE ALLOWED OUTSIDE OF THE RIGHT OF WAYS AND/OR THE LIMITS OF CONSTRUCTION SHOWN ON THE DRAWINGS UNLESS APPROVED BY THE OWNER OR SPECIFICALLY NOTED ON THE DRAWINGS.

EXISTING CONDITIONS

12. EXISTING UTILITIES SHOWN ARE LOCATED ACCORDING TO THE BEST INFORMATION AVAILABLE TO THE ENGINEER AT THE TIME OF THE DESIGN AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR THE ENGINEER. NO GUARANTEE IS MADE THAT ALL EXISTING UNDERGROUND UTILITIES ARE SHOWN OR THAT THE LOCATIONS OF THOSE SHOWN ARE ENTIRELY ACCURATE. FINDING THE ACTUAL LOCATION OF ANY EXISTING UTILITIES IS THE CONTRACTOR'S RESPONSIBILITY AND SHALL BE DONE BEFORE HE COMMENCES ANY WORK IN THE VICINITY. FURTHERMORE, THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES DUE TO THE CONTRACTOR'S FAILURE TO PRECISELY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE OWNER OR ENGINEER WILL ASSUME NO LIABILITY FOR ANY DAMAGES SUSTAINED OR COST INCURRED BECAUSE OF THE OPERATIONS IN THE VICINITY OF EXISTING UTILITIES OR STRUCTURES, NOR FOR TEMPORARY BRACING AND SHORING OF SAME. IF IT IS NECESSARY TO SHORE, BRACE, SWING OR RELOCATED A UTILITY, THE UTILITY COMPANY OR DEPARTMENT AFFECTED SHALL BE CONTACTED AND THEIR PERMISSION OBTAINED REGARDING THE METHOD OF USE FOR SUCH WORK.
13. PRIOR TO SHOP DRAWING PREPARATION AND SUBMITTAL AND PURCHASE OF RELATED MATERIALS, THE CONTRACTOR SHALL FIELD VERIFY EXISTING UTILITIES (LOCATION, SIZE, MATERIALS OF CONSTRUCTION, OUTSIDE DIAMETER, WALL THICKNESS, ROUNDNESS, ELEVATIONS, ETC.) TO WHICH CONNECTION(S) WILL BE MADE. CONTRACTOR SHALL INCLUDE FIELD MEASUREMENTS ON SHOP DRAWINGS.
14. THE CONTRACTOR SHALL NOTIFY THE OWNER AND ENGINEER IN WRITING IMMEDIATELY IF CONFLICTS BETWEEN THE DRAWINGS AND ACTUAL CONDITIONS ARE DISCOVERED. THE CONTRACTOR SHALL ACCURATELY RECORD ANY SUCH CONFLICTS ON THE RECORD DRAWINGS.
15. ANY PROPERTY CORNERS, MONUMENTS, OR BENCH MARKS WITHIN THE PROJECT AREA SHALL BE PROTECTED UNLESS OTHERWISE INDICATED FOR DEMOLITION. IF ANY SUCH ITEMS ARE IN DANGER OF DAMAGE OR HAVE BEEN DAMAGED, THE CONTRACTOR SHALL NOTIFY THE OWNER AND THE ENGINEER IMMEDIATELY AND REPLACE/RESTORE THESE ITEMS AT NO ADDITIONAL COST TO THE OWNER. IF OWNER CHOOSES TO SELF PERFORM THE WORK OR INCURS RELATED EXPENSES, THE CONTRACTOR SHALL REIMBURSE THE OWNER FOR ALL COSTS ASSOCIATED WITH THE EFFORT.

UTILITY COORDINATION

16. THE CONTRACTOR SHALL NOTIFY ALL UTILITIES NEAR THE PROJECT AREA AT LEAST 48 HOURS PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE NOTIFYING "SUNSHINE STATE ONE CALL OF FLORIDA" AT LEAST 48 HOURS PRIOR TO ANY DIGGING WORK TO HAVE ALL EXISTING UTILITIES LOCATED. THE PHONE NUMBER IS 811 OR 1-800-432-4770 AND THE WEB SITE IS WWW.SUNSHINE811.COM. IN INSTANCES WHERE DIGGING OCCURS IN WETLANDS, THE NOTIFICATION PERIOD SHALL BE INCREASED FROM AT LEAST 48 HOURS TO AT LEAST 10 DAYS.
17. FLORIDA LAW (FS 553.851) REQUIRES THAT PERSONS MAKING EXCAVATIONS IN PUBLIC STREETS, ALLEYS, RIGHT-OF-WAYS OR UTILITY EASEMENTS MUST FIRST OBTAIN INFORMATION ON LOCATIONS OF UNDERGROUND GAS PIPELINES.
18. THE CONTRACTOR SHALL PRESERVE AND MAINTAIN EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES WITHIN THE PROJECT AREA. ANY DAMAGE SHALL BE REPAIRED BY AND AT THE EXPENSE OF THE CONTRACTOR TO THE SATISFACTION OF THE OWNER.
19. THE CONTRACTOR IS RESPONSIBLE FOR BRACING, SHORING, OR PROVIDING OTHER MEANS NECESSARY TO PROTECT AND SUPPORT EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES (EXPOSED OR UNEXPOSED) THAT MAY BE IMPACTED BY HIS WORK.
20. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING POWER/TELEPHONE COMPANIES AND ARRANGING TO HAVE UTILITIES POLES HELD AND/OR GUY WIRES REMOVED AND REPLACED, IF NECESSARY FOR CONSTRUCTION, AT NO ADDITIONAL COST TO THE OWNER.

SAFETY

21. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BECOME FAMILIAR WITH THE OSHA EXCAVATION SAFETY STANDARDS AND TO ABIDE BY THEM AS COVERED UNDER THE FLORIDA TRENCH SAFETY ACT.
22. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION SAFETY.

RESTORATION

23. ALL PAVING, STABILIZED EARTH, DRIVEWAYS, CURBS, SIDEWALKS, FENCES, SOD, LANDSCAPING, CULVERTS, ETC. DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE RESTORED BY AND AT THE EXPENSE OF THE CONTRACTOR TO THE SATISFACTION OF THE OWNER.
24. ALL SODDING, SEEDING AND MULCHING SHALL INCLUDE WATERING AND FERTILIZATION AND CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THESE AREAS UP TO AND INCLUDING THE INITIAL MOWING.

ACCESS/MAINTENANCE OF FACILITIES

25. THE CONTRACTOR SHALL PROVIDE ACCESS TO ALL EXISTING UTILITIES/FACILITIES AND MAINTAIN UNINTERRUPTED SERVICES THROUGHOUT THE CONTRACT PERIOD.

PIPING NOTES

26. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS. CONTRACTOR SHALL TAKE CARE TO PROVIDE PROPER GRADE ELEVATIONS AND ALIGNMENTS.
27. SIZE OF FITTINGS SHOWN ON PLANS SHALL CORRESPOND TO THE ADJACENT STRAIGHT RUN OF PIPE UNLESS NOTED OTHERWISE. TYPE OF JOINT AND FITTING MATERIAL SHALL BE AS SPECIFIED FOR THE ADJACENT STRAIGHT RUN OF PIPE UNLESS NOTED OTHERWISE.
28. PIPE HANGERS AND SUPPORTS SHOWN ARE THE MINIMUM REQUIRED. FINAL SUPPORTS, LOCATIONS, AND TYPES SHALL BE DETERMINED BY THE CONTRACTOR AND INCLUDED IN THE PIPELINE DRAWING SUBMITTALS FOR REVIEW AND APPROVAL BY THE ENGINEER PRIOR TO INSTALLATION. MAXIMUM SPACING SHALL BE AS SPECIFIED.
29. THE CONTRACTOR SHALL VERIFY IN THE FIELD THE LOCATION AND ELEVATION OF ALL EXISTING UTILITY CONNECTION POINTS PRIOR TO STARTING CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE ENGINEER AND OWNER OF ANY DISCREPANCIES FOUND.
30. ALL PIPE 4" AND LARGER SHALL BE RESTRAINED UTILIZING MECHANICAL RESTRAINT DEVICES.
31. ALL ABOVE GROUND AND EXPOSED PSW PIPING 1 1/2" AND SMALLER SHALL BE INSULATED AND COVERED AS SPECIFIED.

UTILITY SEPARATION

32. EACH PROPOSED UTILITY SHALL BE LAID TO ACHIEVE THE MINIMUM HORIZONTAL SEPARATION BETWEEN IT AND OTHER UTILITIES IN ACCORDANCE WITH THE TYPICAL UTILITY HORIZONTAL SEPARATION DETAIL 2 SHEET M34 AND FDEP REQUIREMENTS.
33. AT LOCATIONS WHERE A PROPOSED UTILITY CROSSES ANOTHER UTILITY, THE PROPOSED UTILITY SHALL BE INSTALLED IN ACCORDANCE WITH THE TYPICAL UTILITY CONFLICT DETAIL AND FDEP REQUIREMENTS (62-555-314).
34. THE LOWEST PIPE SHALL BE INSTALLED FIRST WHERE PROPOSED UTILITIES CROSS.
35. IN THE EVENT THAT A UTILITY CONFLICT CAN NOT BE RESOLVED BY MAKING A MINOR ROUTE ADJUSTMENT OR BY UTILIZING THE TYPICAL UTILITY CONFLICT DETAIL, THE CONTRACTOR SHALL SUBMIT A RELOCATION PLAN TO THE ENGINEER FOR APPROVAL PRIOR TO COMMENCING WORK. ALL RELOCATIONS EFFORTS SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER AND ANY AFFECTED UTILITY COMPANIES.

UTILITY CONTACT INFORMATION:

ORGANIZATION	CONTACT AND TITLE	TELEPHONE NUMBER
COMCAST CABLE COMMUNICATIONS	ANDREW SWEENEY	904-738-6898
FLORIDA POWER & LIGHT - COLUMBIA	JOEL BRAY	386-586-6403
CITY OF LAKE CITY UTILITIES	BRIAN SCOTT	386-758-5456
LAKE CITY NATURAL GAS / PUBLIC WORKS	DIANE HUNT	386-758-5405
MCI	MCIU01 INVESTIGATIONS	469-886-4091
TECO PEOPLES GAS JACKSONVILLE	-	877-832-6747
AT&T DISTRIBUTION	DINO FARRUGGIO	561-683-2729
CORECIVIC, LAKE CITY CORRECTIONAL FACILITY FOR YOUTHFUL OFFENDERS 7906 EAST HWY. 90 LAKE CITY, FL 32055	RICKY BELL MAINTENANCE SUPERVISOR	386-755-3379
COLUMBIA CORRECTIONAL INSTITUTE, FDC	JOHN GOODWIN, WARDEN	386-754-7600

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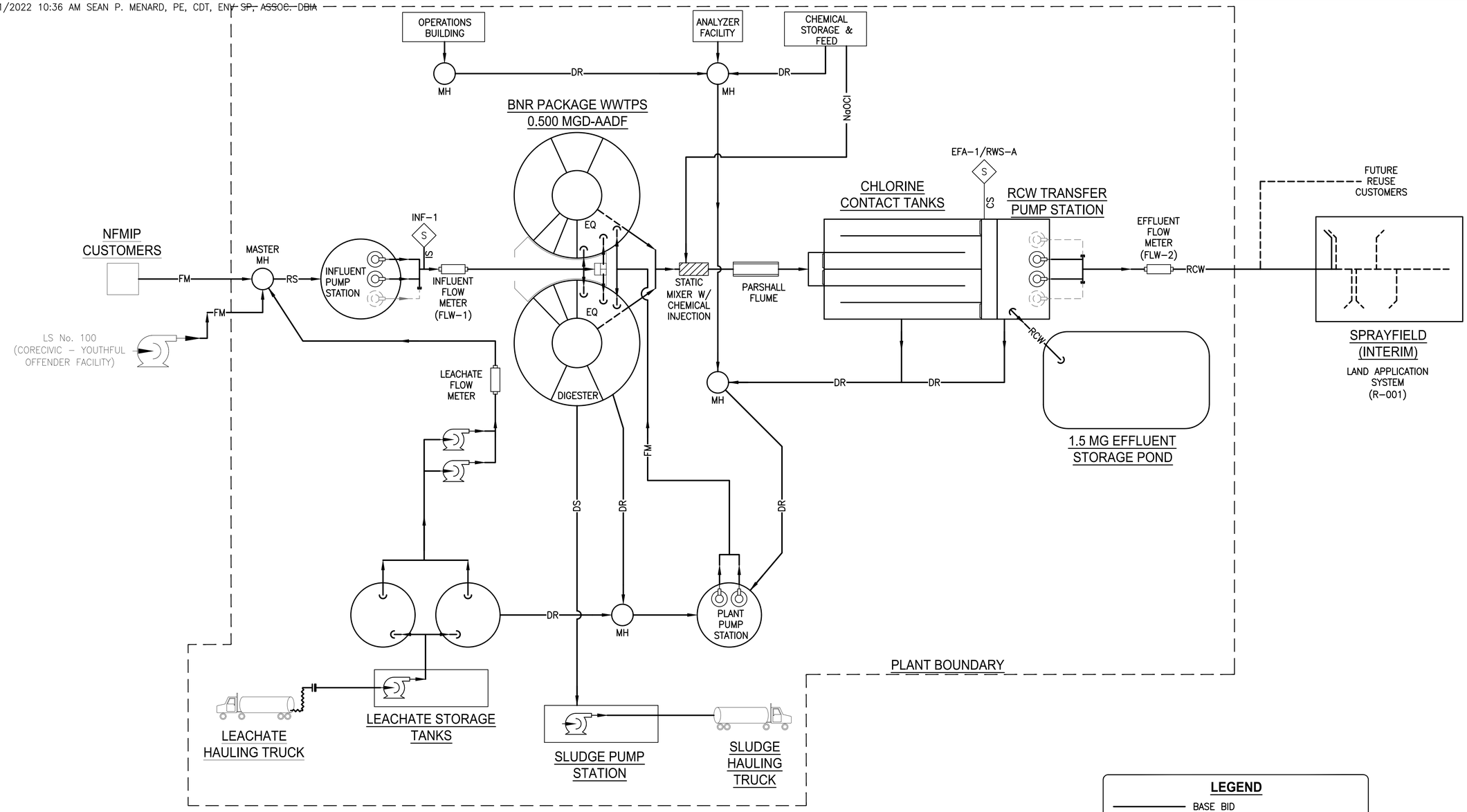
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FLOWSTREAM IDENTIFICATION	
CS	CHLORINE SAMPLE
DR	DRAIN
DS	DIGESTED SLUDGE
FM	FORCE MAIN
IS	INFLUENT SAMPLE
NaOCl	SODIUM HYPOCHLORITE
RS	RAW SEWAGE
RCW	RECLAIMED WATER

LEGEND

- BASE BID
- FUTURE
- ELECTROMAGNETIC FLOWMETER
- PUMP (DRY PIT)
- PUMP (WET PIT)
- SAMPLE
- INF-01 MONITORING SITE NUMBER

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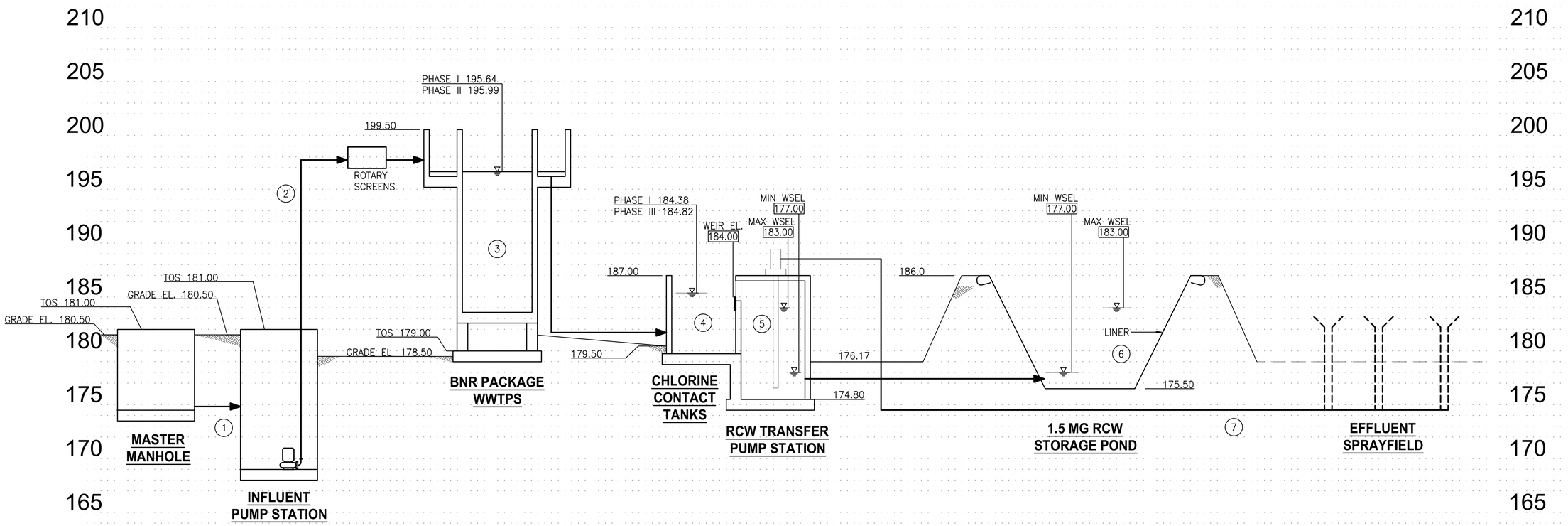
PROCESS FLOW SCHEMATIC

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281
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TREATMENT PLANT DESIGN FLOW

DESIGN FLOW	MGD
AADF	0.50
PHF	1.50
START UP	0.15
PLANT PS	0.04
LEACHATE FLOW	0.01
TRANSFER PUMP STA.	0.50

NOTES:

1. DESIGN FLOWS SHOWN REPRESENT THE TOTAL FLOWS BEING TREATED BY THE NUMBER OF UNITS IN SERVICE FOR EACH UNIT PROCESS STRUCTURE.
2. ACCOUNTS FOR 0.500 MG OF EQUALIZATION TANKS.
3. PROJECT DESIGNED FOR FUTURE EXPANSIONS. PHASE I BEING CONSTRUCTION. PHASE 3 ELEMENTS THAT WILL REMAIN ARE REFERENCED ABOVE AND USE A PHF OF 4.5 MGD.

FLOW SEGMENT SUMMARY - PHASE 1

FLOW SEGMENT No	UNIT PROCESS STRUCTURE	DESIGN FLOW (MGD)	No OF UNITS IN SERVICE	DESIGN FLOW CRITERIA
(1)	INFLUENT PUMPING STATION	1.50	1	PHF
(2)	SCREENS & SPLITTER BOX	1.55	1	PHF + PLANT PS + LEACHATE
(3)	BNR PACKAGE WWTP	0.375 EA.	2	PHF + MAX RAS FLOW + PLANT PS + LEACHATE
(4)	CHLORINE CONTACT TANKS (SEE NOTE 3)	1.5	1	PHF
(5)	TRANSFER PUMP STATION	1	1	PHF
(6)	RCW STORAGE POND	1.50	1	PHF
(7)	EFFLUENT SPRAYFIELD	0.50	1	AADF

LEGEND

- XX.XX — WSEL AT DESIGN FLOW (NAVD88)
- WSEL
- PROPOSED GRADE
- EXISTING GRADE
- (XX) — FLOW SEGMENT NO.

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

HYDRAULIC PROFILE

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GENERAL NOTES:

1. EXISTING TOPOGRAPHY AND IMPROVEMENTS SHOWN ARE BASED ON SURVEY BY MOORE BASS CONSULTING AND LIDAR (BY OTHERS).

2. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH:
   - FDOT SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, CURRENT EDITION;
   - FDOT MANUAL OF UNIFORM MINIMUM STANDARDS FOR DESIGN, CONSTRUCTION AND MAINTENANCE FOR STREETS AND HIGHWAYS (GREEN BOOK);

3. THE FDOT DESIGN STANDARDS (CURRENT EDITION) ARE INCORPORATED IN THESE PLANS BY REFERENCE.

4. IN THE EVENT OF CONFLICTING SPECIFICATIONS, THE MORE CONSERVATIVE OR RESTRICTIVE SPECIFICATION SHALL GOVERN.

5. CONTRACTOR IS RESPONSIBLE TO BE FAMILIAR WITH THE EXISTING CONDITIONS OF THE SITE PRIOR TO CONSTRUCTION.

6. CONTRACTOR SHALL RETURN ALL AREAS DISTURBED DURING THE CONSTRUCTION TO ORIGINAL OR BETTER CONDITION. ITEMS TO BE REPLACED INCLUDE BUT ARE NOT LIMITED TO: CONCRETE PAVEMENT, BASE, ASPHALT PAVEMENT, SOD, LANDSCAPING, WALKS, PAVEMENT MARKINGS, ETC. ALL REPLACEMENT ITEMS SHALL BE INSTALLED TO MATCH EXISTING REMAINDER WITH REGARD TO COLOR, FINISH SIZE, DEPTH, THICKNESS, TYPE AND QUALITY.

7. CONTRACTOR SHALL OBTAIN (FROM ENGINEER OF RECORD) AND REVIEW ALL AVAILABLE GEOTECHNICAL REPORTS PRODUCED FOR THE SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION INCLUDING GEOTECHNICAL REPORT(S) NOTED ABOVE. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING SITE SOIL CONDITIONS AND PREPARATION OF DEWATERING PLAN FOR APPROVAL BY THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT AND COLUMBIA COUNTY ENGINEER PRIOR TO CONSTRUCTION.

8. ALL DIMENSIONS ARE FROM EDGE OF PAVEMENT UNLESS OTHERWISE NOTED.

9. CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTION STAKEOUT AND TESTING. COPIES OF ALL TEST RESULTS FOR SITE WORK SHALL BE PROVIDED TO THE ENGINEER OF RECORD AND COUNTY ENGINEER.

10. THE LOCATION OF ALL EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION COMMENCEMENT. ANY CONFLICTS WITH PROPOSED IMPROVEMENTS SHALL BE REPORTED TO THE ENGINEER OF RECORD IMMEDIATELY. (SUNSHINE ONE 1-800-432-4770)

11. CONTRACTOR IS RESPONSIBLE FOR PROVIDING SIGNED AND SEALED AS-BUILTS SHOWING ALL IMPROVEMENTS CONSTRUCTED UNDER THIS CONTRACT. AS-BUILTS SHALL INCLUDE BOTH ABOVE GROUND AND BURIED UTILITIES INCLUDING ANY EXISTING UTILITIES NOT SHOWN ON THESE PLANS BUT ENCOUNTERED DURING CONSTRUCTION PROCESS. AS-BUILTS SHALL BE SIGNED AND SEALED BY A FLORIDA REGISTERED SURVEYOR. CONTRACTOR SHALL CONTACT ENGINEER OF RECORD FOR SPECIFIC REQUIREMENTS. CONTRACTOR SHALL ALSO PROVIDE FULL AS-BUILT SURVEY IN AUTOCAD ELECTRONIC FORMAT.

12. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SAFE VEHICULAR AND PEDESTRIAN ACCESS ROUTED AROUND THE PROPOSED CONSTRUCTION AREA THROUGHOUT THE CONSTRUCTION SEQUENCE. A MAINTENANCE OF TRAFFIC PLAN SHALL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE FDOT DISTRICT 2 OFFICE FOR APPROVAL PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

13. THE CONTRACTOR SHALL NOT SUBSTITUTE ANY ARTICLE, DEVICE, PRODUCT, MATERIAL, FIXTURE, OR ANY FORM OR TYPE OF CONSTRUCTION, FOR THAT WHICH IS INDICATED IN THE APPROVAL PLANS WITHOUT THE WRITTEN APPROVAL BY THE ENGINEER OF RECORD AND/ OR COUNTY ENGINEER.

14. IN THE EVENT THAT A STRUCTURAL FAILURE (SINK FEATURE) OCCURS DURING CONSTRUCTION, ALL CONSTRUCTION ACTIVITY SHALL CEASE AND A FLORIDA REGISTERED GEOTECHNICAL ENGINEER SHALL BE CONTACTED IMMEDIATELY. A CORRECTIVE MEASURES PLAN MUST BE APPROVED BY THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT AND IMPLEMENTED PRIOR TO RESUMING CONSTRUCTION.

15. IF PREHISTORIC OR HISTORIC ARTIFACTS, SUCH AS POTTERY OR CERAMICS, STONE TOOLS, METAL IMPLEMENTS, DUGOUT CANOES OR ANY OTHER PHYSICAL REMAINS THAT COULD BE ASSOCIATED WITH NATIVE AMERICAN CULTURES OR EARLY COLONIAL OR AMERICAN SETTLEMENT ARE ENCOUNTERED AT ANY TIME WITHIN THE PROJECT SITE AREA, THE PERMITTED PROJECT SHOULD CEASE ALL ACTIVITIES INVOLVING SUBSURFACE DISTURBANCE IN THE IMMEDIATE VICINITY OF SUCH DISCOVERIES. THE PERMITTEE OR OTHER DESIGNEE, SHOULD CONTACT THE FLORIDA DEPARTMENT OF STATE, DIVISION OF HISTORICAL RESOURCES, REVIEW AND COMPLIANCE SECTION, AT (850) 245-6333 OR (800) 847-7278, AS WELL AS THE APPROPRIATE PERMITTING AGENCY OFFICE. PROJECT ACTIVITIES SHOULD NOT RESUME WITHOUT VERBAL AND/OR WRITTEN AUTHORIZATION FROM THE DIVISION OF HISTORICAL RESOURCES. IN THE EVENT THAT UNMARKED HUMAN REMAINS ARE ENCOUNTERED DURING PERMITTED ACTIVITIES, ALL WORK SHALL STOP IMMEDIATELY, AND THE PROPER AUTHORITIES NOTIFIED IN ACCORDANCE WITH SECTION 872.05, FLORIDA STATUTES.

DEMOLITION & EROSION CONTROL:

1. CONTRACTOR IS RESPONSIBLE FOR THE CONSTRUCTION (AND MAINTENANCE DURING CONSTRUCTION) OF ALL SEDIMENTATION AND EROSION CONTROL DEVICES.

2. CONTRACTOR SHALL REFER TO SEDIMENTATION AND EROSION CONTROL PLAN FOR LIMITS OF CLEARING AND EROSION CONTROLS.

3. SEDIMENTATION AND EROSION CONTROL DEVICES SHALL BE CONSTRUCTED AS NECESSARY, IN ADDITION TO THOSE SHOWN ON THE PLANS, TO PROTECT ADJACENT PROPERTY OWNERS FROM RECEIVING SEDIMENTATION DURING CONSTRUCTION.

4. CONTRACTOR SHALL FOLLOW BEST MANAGEMENT PRACTICES FOR EROSION & SEDIMENT CONTROL AS DETAILED IN CHAPTER 6 OF THE FLORIDA DEVELOPMENT MANUAL: A GUIDE TO SOUND LAND AND WATER MANAGEMENT, FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (1988).

5. CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE COUNTY ENGINEER (OR THEIR DESIGNEE) TO INSPECT SEDIMENTATION CONTROLS PRIOR TO CONSTRUCTION COMMENCEMENT.

6. CONTRACTOR SHALL PROVIDE THE NAME OF A DESIGNATED EROSION CONTROL OFFICER WHO HAS BEEN CERTIFIED UNDER THE FLORIDA STORMWATER, EROSION, AND SEDIMENTATION CONTROL INSPECTOR TRAINING PROGRAM. THIS PERSON SHALL IDENTIFIED DURING THE PRE-CONSTRUCTION CONFERENCE AND SHALL BE AVAILABLE AT ALL TIMES DURING CONSTRUCTION ACTIVITIES.

7. WHEN NECESSARY, VEHICLES SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO U.S. HIGHWAY 90. IF WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA WHICH DRAINS INTO AN APPROVED SEDIMENT TRAP OR BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM PIPE, DITCH OR WATERCOURSE THROUGH THE USE OF SAND BAGS, HAYBALES, GRAVEL, BOARDS OR OTHER APPROVED METHODS.

8. CONTRACTOR SHALL PROVIDE STREET SWEEPING AS NECESSARY TO ENSURE US HIGHWAY 90 IS SEDIMENT FREE. MACHINE SWEEPING SHALL OCCUR WITHIN 24 HOURS OF TRACKING ANY SEDIMENT ON THE ROADWAY.

9. A SITE-SPECIFIC STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SHALL BE PREPARED BY THE CONTRACTOR AND PROVIDED TO THE COUNTY ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION COMMENCEMENT. SWPPP SHALL BE SUBMITTED TO FDEP/EPA AS A PART OF NPDES AND THE NOTICE OF INTENT SUBMITTAL.

10. CLEARING AND CONSTRUCTION DEBRIS SHALL BE DISPOSED OF IN A LEGAL MANNER AND LOCATION.

11. CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT EXISTING UTILITIES FROM DAMAGE AND SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT OF ANY EXISTING UTILITIES IMPACTED BY CONSTRUCTION.

12. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OF UNFORESEEN MATERIALS CONFLICTING WITH CONSTRUCTION INDICATED ON PLANS.

13. IF WELLS ARE ENCOUNTERED ON SITE, THEY SHALL BE ABANDONED BY A FLORIDA CERTIFIED WELL DRILLER USING ABANDONMENT PROCEDURES AND PERMITTING PROCESS OF THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT OR OTHER APPLICABLE REGULATORY AGENCY.

14. ALL EXCAVATED SOILS SHALL BE STOCKPILED IN LOCATION(S) INDICATED ON PLANS. NO STOCKPILE OR STAGING SHALL OCCUR IN THE FDOT RIGHT-OF-WAY. APPROPRIATE SEDIMENTATION CONTROLS SHALL BE INSTALLED AROUND THE STOCKPILE(S) AND STAGING AREA(S). ALTERNATE STOCKPILE LOCATIONS MAY BE COORDINATED WITH THE COUNTY ENGINEER (OR THEIR DESIGNEE).

STABILIZATION NOTES:

1. CONTRACTOR SHALL SOD ALL DISTURBED AREAS WITH 6:1 SLOPE OR GREATER AND SHALL LAP & PIN SOD ON ALL SLOPES 2:1 AND GREATER

2. CONTRACTOR SHALL SOD ALL DISTURBED AREAS WITHIN U.S. HIGHWAY 90 RIGHT OF WAY.

3. CONTRACTOR SHALL SOD 1' WIDTH ADJACENT TO ALL PERIMETER PAVED AREAS.

4. CONTRACTOR SHALL SOD SWMF SIDE SLOPES AND UNLINED PORTIONS OF THE EFFLUENT STORAGE POND.

5. ALL SOD SHALL BE CENTIPEDED SOD.

6. ALL DISTURBED AREAS NOT PAVED, SODDED OR OTHERWISE LANDSCAPED SHALL BE SEEDED, FERTILIZED AND MULCHED PER FDOT SPECIFICATIONS, SECTION 570. SEEDING RATE AND MIX SHALL COMPLY WITH THE SEEDING RATE TABLE OF FDOT STANDARD INDEX 105.

7. ALL DISTURBED AREAS, NOT OTHERWISE STABILIZED AND TO BE LEFT IDLE LONGER THAN 14 DAYS MUST BE STABILIZED WITH QUICK GROW GRASS SEED AND MULCH. UPON COMPLETION OF GRADING ACTIVITIES, CONTRACTOR SHALL STABILIZE ALL DISTURBED AREAS EXCEPT OTHER AREAS STABILIZED WITH SOD. STABILIZATION SHALL CONSIST OF SEED AND MULCH PER F.D.O.T. SPECIFICATIONS.

LINETYPE LEGEND

- EXISTING FEATURES
- PROPOSED FEATURES
- EXISTING RIGHT-OF-WAY
- PROPOSED RIGHT-OF-WAY
- EXISTING UNDERGROUND TELECOMMUNICATIONS
- PROPOSED UNDERGROUND TELECOMMUNICATIONS
- EXISTING UNDERGROUND ELECTRIC
- PROPOSED UNDERGROUND ELECTRIC
- EXISTING FIBER OPTIC
- PROPOSED FIBER OPTIC
- EXISTING GAS MAIN
- PROPOSED GAS MAIN
- EXISTING SANITARY SEWER MAIN
- PROPOSED SANITARY SEWER MAIN
- EXISTING FORCE MAIN
- PROPOSED FORCE MAIN
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING WATER MAIN
- PROPOSED WATER MAIN
- EXISTING FENCE
- PROPOSED FENCE

SYMBOLS LEGEND

EXISTING	PROPOSED	
PP	PP	POWER POLE
PP/TP	PP/TP	COMBINATION POLE
TP	TP	TELEPHONE POLE
TEL PED	TEL PED	TELEPHONE PEDESTAL
SIG-P	SIG-P	SIGNAL POLE
LP	LP	LIGHT POLE
		GUY ANCHOR
GM	GM	GAS METER
GV	GV	GAS VALVE
S	S	SANITARY SEWER MANHOLE
		SANITARY SEWER FLOW ARROW
		FIRE HYDRANT
WV	WV	WATER VALVE
M	M	WATER METER
		STORM MANHOLE
		CURB INLET
		GRATE INLET
		STORM FLOW ARROW

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GENERAL NOTES

This item has been digitally signed and sealed by Amir Darabi on the date indicated here.

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Amir Darabi,
State of Florida, Professional Engineer,
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805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO:
	C1

UTILITY NOTES:

1. PIPE LENGTHS SHOWN ARE FROM CENTER OF STRUCTURE TO CENTER OF STRUCTURE.
2. ALL MANHOLES, INLETS AND CLEANOUTS SUBJECT TO VEHICULAR LOADING, INCLUDING THOSE AREAS REQUIRING FUTURE MAINTENANCE, SHALL HAVE TRAFFIC BEARING (H-20) RINGS, COVERS, GRATES, ETC.
3. CONTRACTOR IS RESPONSIBLE TO PROTECT EXISTING UTILITIES FROM DAMAGE DURING CONSTRUCTION.

GRADING NOTES:

1. CONTRACTOR SHALL REVIEW GEOTECHNICAL REPORT FOR EARTHWORK AND GRADING RECOMMENDATIONS AND REQUIREMENTS FOR THIS PROJECT WHICH MAY EXCEED THE NOTES SPECIFIED HEREIN. IN THE EVENT OF CONFLICTING SPECIFICATIONS, THE GEOTECHNICAL REPORT SHALL GOVERN.
2. GROUND SURFACE PREPARATION: REMOVE VEGETATION INCLUDING GRASS, ROOTS AND SURFICIAL ORGANICS, DEBRIS, UNSATISFACTORY SOIL MATERIALS, OBSTRUCTIONS, AND DELETERIOUS MATERIALS FROM GROUND SURFACE PRIOR TO PLACEMENT OF FILL. PLOW STRIP OR BREAK UP SLOPED SURFACES STEEPER THAN 1 VERTICAL TO 2 HORIZONTAL SO THAT FILL MATERIAL WILL BOND WITH EXISTING SURFACE.
3. AREAS OF CUT AND FILL SHALL BE STRIPPED OF ALL VEGETATION, SOD, AND TOPSOIL. OVER-EXCAVATION SHALL BE PERFORMED WHEREVER ORGANIC MATERIALS WILL CREATE A WEAK ZONE IN THE EARTH MASS. AS SPECIFIED IN THE GEOTECHNICAL REPORT(S), AREAS WHERE ORGANIC CONTENT EXCEEDS THE ALLOWABLE REQUIREMENT SHALL BE OVER EXCAVATED AND BACKFILLED.
4. REMOVE AND REPLACE OR SCARIFY AND AIR-DRY SOIL MATERIAL THAT IS TOO WET TO PERMIT COMPACTION TO SPECIFIED DENSITY. DO NOT PLACE BACKFILL OR FILL MATERIAL ON SURFACES THAT ARE MUDDY, FROZEN OR CONTAIN FROST OR ICE.
5. MOISTURE CONTROL: WHERE SUBGRADE OR LAYER OF SOIL MATERIAL MUST BE MOISTURE CONDITIONED BEFORE COMPACTION, UNIFORMLY APPLY WATER TO SURFACE OF SUBGRADE OR LAYER OF SOIL MATERIAL. APPLY WATER IN MINIMUM QUANTITY AS NECESSARY TO PREVENT FREE WATER FROM APPEARING ON SURFACE DURING OR SUBSEQUENT TO COMPACTION OPERATIONS. COMPACT EACH LAYER TO REQUIRED PERCENTAGE OF MAXIMUM DRY DENSITY OR RELATIVE DRY DENSITY FOR EACH AREA CLASSIFICATION, AS SPECIFIED IN THE GEOTECHNICAL REPORTS OR HEREIN.
6. SPREAD SOIL MATERIAL THAT HAS BEEN REMOVED BECAUSE IT IS TOO WET TO PERMIT COMPACTION. ASSIST DRYING BY DISCING, HARROWING, OR PULVERIZING UNTIL MOISTURE CONTENT IS REDUCED TO A SATISFACTORY VALUE.
7. PLACE BACKFILL AND FILL MATERIALS IN LAYERS NOT MORE THAN 12 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HEAVY COMPACTION EQUIPMENT, AND NOT MORE THAN 6 INCHES IN LOOSE DEPTH FOR MATERIAL COMPACTED BY HAND-OPERATED TAMPERS. COMPACT SUBGRADE AND EACH LAYER OF BACKFILL OR FILL MATERIAL TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY. REFER TO GEOTECHNCIAL REPORT(S) FOR FURTHER DETAIL AND INSTRUCTION.
8. ALL AREAS UNDER PROPOSED PAVEMENTS AND STRUCTURES SHALL BE COMPACTED TO A MINIMUM OF 98% OF MODIFIED PROCTOR MAXIMUM DRY DENSITY. REFER TO GEOTECHNCIAL REPORT(S) FOR FURTHER DETAIL AND INSTRUCTION.
9. QUALITY CONTROL TESTING DURING CONSTRUCTION: CONTRACTOR SHALL BE RESPONSIBLE FOR GEOTECHNICAL TESTING (BY A FLORIDA REGISTERED GEOTECHNICAL ENGINEER) TO INSPECT AND APPROVE EACH SUBGRADE AND BACKFILL OR FILL LAYER BEFORE FURTHER BACKFILL OR CONSTRUCTION WORK IS PERFORMED. TEST SHALL BE PERFORMED EVERY 10,000 SQUARE FEET OF AREA PER ONE FOOT LIFT.

CONSTRUCTION SEQUENCE:

1. A PRE-CONSTRUCTION MEETING SHALL BE CALLED PRIOR TO INITIATING ANY SITE WORK, INCLUDING CLEARING AND GRUBBING. AT A MINIMUM, THE ATTENDEES SHALL BE REPRESENTATIVES FROM: COLUMBIA COUNTY PUBLIC WORKS DEPARTMENT, SUWANNEE RIVER WATER MANAGEMENT DISTRICT, MOORE BASS CONSULTING, INC., FDOT DISTRICT 2, WEYERHAEUSER, AND JONES EDMUNDS AND ASSOCIATES.
2. CONTRACTOR SHALL SUBMIT A NOTICE OF COMMENCEMENT TO THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT IN ORDER TO SECURE APPROVAL TO COMMENCE CONSTRUCTION. DUPLICATE NOTICE SHALL BE SUBMITTED TO THE COUNTY ENGINEER (OR THEIR DESIGNEE).
3. CONTRACTOR SHALL PREPARE AND SUBMIT MAINTENANCE-OF-TRAFFIC (MOT) PLAN TO FDOT DISTRICT 2 (FOR US90) FOR APPROVAL PRIOR TO INITIATING ANY CONSTRUCTION ACTIVITY IN THE US90 RIGHT-OF-WAY.
4. POST ALL APPLICABLE PERMIT PLACARDS. THE PERMIT PLACARDS SHALL NOT BE NAILED TO TREES.
5. INITIATE APPROVED MOT PLAN, AS REQUIRED.
6. CONSTRUCT GRAVEL CONSTRUCTION ENTRANCES.
7. FLAG OR STAKE THE PROPOSED LIMITS OF CLEARING PRIOR TO DEMOLITION COMMENCEMENT.
8. DESIGNATE EMPLOYEE PARKING AREAS (NOT LOCATED WITHIN THE U.S. HIGHWAY 90), MATERIALS STORAGE AREAS, AND TOPSOIL STORAGE AREAS.
9. DESIGNATE REFUELING AREAS (NOT LOCATED WITHIN THE U.S. HIGHWAY 90 RIGHT-OF-WAY). REFUELING AREAS TO BE LOCATED A SUITABLE DISTANCE AWAY FROM NEARBY WATER BODIES OR WETLANDS.
10. CONSTRUCT SEDIMENTATION CONTROL DEVICES ALONG THE LIMITS OF CLEARING AND AS INDICATED IN THE SEDIMENTATION AND EROSION CONTROL PLAN.
11. CLEAR & GRUB LIMITS OF CLEARING.
12. EXCAVATE STORMWATER MANAGEMENT FACILITY AREA.
13. IN FILL AREAS, PREPARE SUITABLE SOILS PER GEOTECHNICAL REPORT(S).
14. COORDINATE WITH COUNTY AND MECHANICAL ENGINEER FOR SEQUENCE AND TIMING OF UTILITY INSTALLATIONS.
15. IF DIRECTED BY BID ALTERNATE, INSTALL UTILITIES AS DIRECTED BY COUNTY (TIMING OF UTILITY TAPS/CONNECTIONS TO BE SPECIFIED BY COUNTY).
16. CONSTRUCT SWMF, STORMWATER CONVEYANCE SWALES, STORM DRAINS AND STRUCTURES. INSTALL INLET PROTECTION PER DETAIL.
17. CONSTRUCT SUBGRADE FOR ROAD AREAS IN ACCORDANCE WITH INCORPORATED SPECIFICATIONS AND GRADING NOTES ON THIS SHEET.
18. CONSTRUCT BASE FOR ROAD AREAS.
19. CONSTRUCT ASPHALT AND GRAVEL ROAD SURFACES.
20. INSTALL PAVEMENT MARKINGS AND SIGNAGE.
21. PERFORM FINE GRADING
22. SEED, MULCH AND/OR SOD ALL DISTURBED AREAS.
23. CONTRACTOR SHALL SUBMIT A VIDEO OF THE STORMWATER PIPES TO THE COUNTY ENGINEER IN ACCORDANCE WITH FDOT STANDARD SPECIFICATIONS JANUARY 2017 (SECTION 430 SUBARTICLE 4.8.1), PRIOR TO PLACING THE LAST LAYER OF ASPHALT.
24. REMOVE SEDIMENTS FROM STORMDRAIN PIPE AND ANY SEDIMENT WITHIN SWALES AND SWMF BOTTOMS.
25. APPROXIMATELY TWO WEEKS PRIOR TO REQUESTING THE FINAL ENVIRONMENTAL INSPECTION, AS-BUILT RECORD DRAWINGS AND THE COMPLIANCE REPORT MUST BE SUBMITTED TO THE COUNTY ENVIRONMENTAL INSPECTOR AND COLUMBIA COUNTY PUBLIC WORKS FOR REVIEW.
26. AS-BUILT CERTIFICATIONS SHALL BE SUBMITTED TO THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT WITHIN 30 DAYS OF PROJECT COMPLETION.

DEWATERING PLAN:

1. THE PROJECT AREA CONTAINS A RELATIVELY HIGH GROUNDWATER TABLE AS REFERENCED IN THE GEOTECHNICAL REPORTS. THIS WILL HAVE A SIGNIFICANT INFLUENCE ON THE PROPOSED CONSTRUCTION ACTIVITIES, INCLUDING THE ABILITY TO ACHIEVE PROPER SOIL COMPACTION.
2. A DEWATERING PLAN SHALL BE PREPARED BY THE CONTRACTOR AND SUBMITTED TO THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT AND COUNTY ENGINEER FOR APPROVAL PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITY.
3. CONTRACTOR MAY USE EITHER WELL-POINTING OR THE EXCAVATION OF SUMPS OR TRENCHES TO DEWATER AREAS FOR CONSTRUCTION OR OTHER METHOD APPROVED BY THE ENGINEER OF RECORD AND COUNTY ENGINEER (OR THEIR DESIGNEE).
4. ALL DEWATERING EFFLUENT SHALL MEET STATE WATER QUALITY STANDARDS BEFORE ENTERING WETLAND AREAS OR LEAVING THE PROJECT AREA.
5. EFFLUENT SHOULD BE DISCHARGED INTO VEGETATED AREAS AT A DISTANCE GREAT ENOUGH FROM DOWNSTREAM WETLANDS OR NATURAL CONVEYANCES THAT EFFLUENT HAS ADEQUATE TIME TO INFILTRATE INTO THE GROUND OR ALLOW SUSPENDED SOLIDS TO SETTLE OUT PRIOR TO ENTERING WETLAND OR CONVEYANCE.
6. AS AN ALTERNATIVE TO NOTE #5 ABOVE, CONTRACTOR MAY CONSTRUCT A TEMPORARY FILTER SYSTEM CAPABLE OF FILTERING EFFLUENT TO MEET STATE WATER QUALITY STANDARDS.
7. NO EXCAVATION, CLEARING, OR LAND DISTURBANCE SHALL OCCUR OUTSIDE THE LIMITS OF THE PROJECT AREA OR WITHIN WETLANDS NOT SHOWN AS IMPACTED.

STANDARD ABBREVIATIONS

AC	ACRE
ADT	AVERAGE DAILY TRAFFIC
AADT	ANNUAL AVERAGE DAILY TRAFFIC
AGG	AGGREGATE
ALT	ALTERNATE
ALUM	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
ASPH	ASPHALT
ASSEM	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
AVE	AVENUE
B/C	BACK OF CURB
BCCMP	BITUMINOUS COATED CORRUGATED METAL PIPE
BCPA	BITUMINOUS COATED PIPE ARCH CULVERT
BE	BURIED ELECTRIC
BL	BASE LINE
BLDG	BUILDING
BLVD	BOULEVARD
BM	BENCH MARK
BNDY	BOUNDARY
BT	BURIED TELEPHONE CABLE or DUCT
C & G	CURB AND GUTTER
CATV	CABLE TELEVISION
CB	CATCH BASIN
CF	CUBIC FOOT
CFS	CUBIC FEET PER SECOND
CI	CAST IRON
CIPL	CAST IN PLACE
CKT	CIRCUIT
CL	CENTER LINE
CM	CONCRETE MONUMENT
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CONST	CONSTRUCT or CONSTRUCTION
CPE	CORRUGATED POLYETHYLENE PIPE
CSX	CSX TRANSPORTATION, INC.
CY	CUBIC YARD
D	DEGREE OF CURVATURE
DBI	DITCH BOTTOM INLET
DECEL	DECELERATION
DHW	DESIGN HIGH WATER
DIA	DIAMETER
e	RATE OF SUPERELEVATION
E	EAST
EA	EACH
ECR	ENGINEERED CONCRETE RUBBER (ECR), BY OMNI
EL OR ELEV	ELEVATION
ELEC	ELECTRIC
E.O.R.	ENGINEER OF RECORD
ESMT	EASEMENT
EXIST	EXISTING
FC	FRICTION COURSE
FDN	FOUNDATION
FDOT	FLORIDA DEPARTMENT OF TRANSPORTATION
FE	FLOOR ELEVATION
FES	FLARED END SECTION
FH	FIRE HYDRANT
FL	FLOW LINE
FL or FLA	FLORIDA
FT	FEET or FOOT
GM	GAS MAIN
HD	HIGH DENSITY OR HEAVY DUTY
HORIZ	HORIZONTAL
HWY	HIGHWAY
HYD	HYDRANT
IFC	INTERNATIONAL FIRE CODE
JB	JUNCTION BOX
JCT	JUNCTION
L	LENGTH or LENGTH OF CURVE
LB	POUND
LBR	LIMEROCK BEARING RATIO
LT	LEFT
MAX	MAXIMUM
MES	MITERED END SECTION
MG	MILLION GALLON
MH	MANHOLE
MHW	MEAN HIGH WATER
MIN	MINIMUM
MISC	MISCELLANEOUS
MON	MONUMENT
MOT	MAINTENANCE OF TRAFFIC
MUTCD	MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES
N	NORTH
NA or N/A	NOT AVAILABLE or NOT APPLICABLE
N & C	NAIL & CAP
NE	NORTHEAST
NGVD	NATIONAL GEODETIC VERTICAL DATUM of 1929
NGS	NATIONAL GEODETIC SURVEY
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
NW	NORTHWEST
OC	ON CENTER
OE	OVERHEAD ELECTRIC
OT	OVERHEAD TELEPHONE
PAVT	PAVEMENT
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PED	PEDESTRIAN or PEDESTAL
PGL	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
PKG	PARKING
PL	PROPERTY LINE
POC	POINT ON CURVE
PP	POWER POLE
PRC	POINT OF REVERSE CURVATURE
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
Q	PEAK DISCHARGE or FLOW VOLUME
R or RAD	RADIUS
RCP	REINFORCED CONCRETE PIPE
RCPA	REINFORCED CONCRETE PIPE ARCH
RDWY	ROADWAY
RPM	RAISED REFLECTIVE PAVEMENT MARKERS
RR	RAILROAD
RT	RIGHT
R/W	RIGHT OF WAY
S	SOUTH
SAN	SANITARY
SD	SIDE DRAIN, STORM DRAIN
SE	SOUTHEAST
SECT	SECTION
SERV	SERVICE
SH or SHT	SHEET
SPEC	SPECIFICATION
SF	SQUARE FOOT
SY	SQUARE YARD
SR	STATE ROAD
SRE	SKEEN RAILROAD ENGINEERING
SS	SANITARY SEWER
STA	STATION
STD	STANDARD
STY	STORY
SW	SOUTHWEST
T or TAN	TANGENT LENGTH OF CURVE or THICKNESS
T or TWP	TOWNSHIP
TBM	TEMPORARY BENCH MARK
TC	TANGENT TO CURVE
TCE	TEMPORARY CONSTRUCTION EASEMENT
TCP	TERRA COTTA PIPE
TCZ	TRAFFIC CONTROL ZONE
TEL	TELEPHONE
TN	TON
TYP	TYPICAL
UG	UNDERGROUND
USGS	US GEOLOGICAL SURVEY
UTIL	UTILITIES
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
W	WEST
WB40	INTERMEDIATE SEMI TRAILER (40' WB)
WB50	LARGE SEMI TRAILER (50' WB)
WB60	TANDEM SEMI TRAILER (60' WB)
WM	WATER MAIN
WWF	WELDED WIRE FABRIC

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JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MooreBass CONSULTING TALLAHASSEE ATLANTA www.moorebass.com

GENERAL NOTES

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Amir Darabi,
State of Florida, Professional Engineer,
License No. 68298
805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO:
	C2

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NORTH

GRAPHIC SCALE

0 60 120 240

1 inch = 120 ft.

EXISTING UTILITY DETAIL WITHIN U.S. 90 CORRIDOR (N.T.S.)

- US 90 RIGHT-OF-WAY
- FO — BURIED FIBER OPTIC LINE (MCI)
- BT — BURIED TELEPHONE LINE (AT&T)

EXISTING U.S. HIGHWAY 90

- FO — BURIED FIBER OPTIC LINE (AT&T)
- OE — OVERHEAD ELECTRIC DISTRIBUTION LINE (FLORIDA POWER & LIGHT)
- NFMIP BOUNDARY / US 90 RIGHT-OF-WAY
- W — 12" PVC WATER MAIN (CITY OF LAKE CITY)
- FM — 6" SANITARY SEWER FORCE MAIN (CITY OF LAKE CITY)
- GAS — 6" GAS MAIN (CITY OF LAKE CITY)

GENERAL NOTES:

1. NO IMPROVEMENTS LOCATED OTHER THAN SHOWN HEREON.
2. ELEVATIONS ARE BASED ON NAVD 88 DATUM.
3. TWO BENCHMARKS HAVE BEEN ESTABLISHED AND ARE DENOTED HEREON.
4. THIS IS NOT A BOUNDARY SURVEY.
5. EXISTING UTILITY DETAIL BASED UPON PRIOR SOFT-DIG DATA PROVIDED BY CARDNO TBE FROM TESTING LOCATIONS ALONG NFMIP NORTHERN BOUNDARY.
6. WETLAND DELINEATION AND SURVEY BY OTHERS; WETLAND LINEWORK SHOWN IS FROM APPROVED NFMIP CONCEPTUAL ENVIRONMENTAL RESOURCE PERMIT.
7. CONTOURS SHOWN ARE A COMPILATION OF FIELD LOCATED TOPOGRAPHIC SURVEY BY MOORE BASS CONSUTLING AND LIDAR SCAN.
8. ADDITIONS OR DELETIONS TO SURVEY MAP OR REPORT BY OTHER THAN THE SIGNING PARTY OR PARTIES IS PROHIBITED WITHOUT WRITTEN CONSENT OF THE SIGNING PARTY OR PARTIES.
9. ALL UTILITIES SHOWN HEREON ARE BASED ON SURFACE EVIDENCE. ANY UTILITIES NOT SHOWN ARE LACKING SURFACE EVIDENCE TO MAKE A DETERMINATION OF LOCATION IN THE FIELD.

STANDARD ABBREVIATIONS:

#000	PROFESSIONAL LAND SURVEY CERTIFICATE
(D)	DEED INFORMATION
(S)	SURVEY INFORMATION
AC.	ACRES
Δ=	DELTA OR CENTRAL ANGLE
E	EAST
EL.	ELEVATION
FO	FIBER OPTIC
FPIP	FOUND PINCHED IRON PIPE (AS LABELED)
HDPE	HIGH-DENSITY POLYETHYLENE PIPE
INV.	INVERT
L=	ARC LENGTH
MES	MITERED END SECTION
N	NORTH
OE	OVERHEAD ELECTRIC
O.R./PG.	OFFICIAL RECORDS BOOK AND PAGE
OT	OVERHEAD TELEPHONE
OTV	OVERHEAD TELEVISION
OU	OVERHEAD UTILITY
PVC	POLYVINYL CHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
R/W	RIGHT-OF-WAY
S	SOUTH
TYP	TYPICAL
TBM	TEMPORARY BENCHMARK
W	WEST

TREE ABBREVIATIONS:

ABBREVIATION	COMMON NAME
SHP	SLASH PINE

SYMBOL LEGEND

- FOUND IRON ROD (AS LABELED)
- FOUND CONCRETE MONUMENT (AS LABELED)
- SET 1/2" IRON PIN W/ CAP LB#7245
- UTILITY POLE
- E — ELECTRIC METER
- FIRE HYDRANT
- WATER VALVE
- GAS VALVE
- SINGLE SUPPORT SIGN

EXISTING LS 100

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

NFMIP BNDRY

U.S. HIGHWAY 90 (R/W VARIES)

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXISTING WETLANDS

CONSERVATION AREA "D" WITH WETLANDS

WASTEWATER TREATMENT FACILITY AREA 17.64 AC± (S)

WWTP SITE BNDRY

EXISTING WETLANDS

EXISTING WETLANDS

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NORTH FLORIDA MEGA INDUSTRIAL PARK WASTEWATER TREATMENT PLANT COLUMBIA COUNTY, FLORIDA

MooreBass CONSULTING TALLAHASSEE ATLANTA www.moorebass.com

EXISTING CONDITIONS MAP

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805 N. GADSDEN STREET
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PROJECT NO: 03780-001-01
DATE: APRIL 2022
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DWG NO: C3

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APPROXIMATE LOCATION OF NGS BENCHMARK PID BD2277 DESIGNATION "M 370" PUBLISHED ELEVATION: 187.17' (NAVD 88 - ORTHO HEIGHT)

N 81°00'42" E 465.57' (C)

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

FCM 4"X4" 1428

GAS PIPELINE MARKER

TBM ELEV: 187.02

NFMIP BNDRY

TBM ELEV: 184.03

TBM ELEV: 181.20

6' CHAIN LINK FENCE

SSS: STATE PRISONERS WORKING

SSS: TRUCKS ENTERING HIGHWAY

HYDRANT WITH WATER VALVES (2)

TBM ELEV: 184.03

GAS PIPELINE MARKER

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

U.S. HIGHWAY 90 R/W VARIES

SSS: CABLE ROUTE - SOUTHERN BELL

R/W

FIRC 5/8" F.D.O.T.

EXISTING WETLANDS

EXISTING WETLANDS

(SHEET C3) MATCHLINE (SHEET C4)

NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

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03780-001-01	APRIL 2022
INDEX NO:	DWG NO:
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NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

6' CHAIN LINK FENCE

6' CHAIN LINK FENCE

NFMIP BNDRY

FCM 4"X4"
4432

TBM
ELEV: 177.13

WWTP SITE BNDRY

WWTP SITE BNDRY

WWTP SITE BNDRY

MATCHLINE (SHEET C3)

(SHEET C4)

WASTEWATER TREATMENT
FACILITY AREA
17.64 AC± (S)

EXISTING
WETLANDS

EXISTING
WETLANDS

EXISTING
WETLANDS

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NORTH

GRAPHIC SCALE

0 60 120 240

1 inch = 120 ft.

SEDIMENT AND EROSION CONTROL MAINTENANCE/INSPECTION PROCEDURES

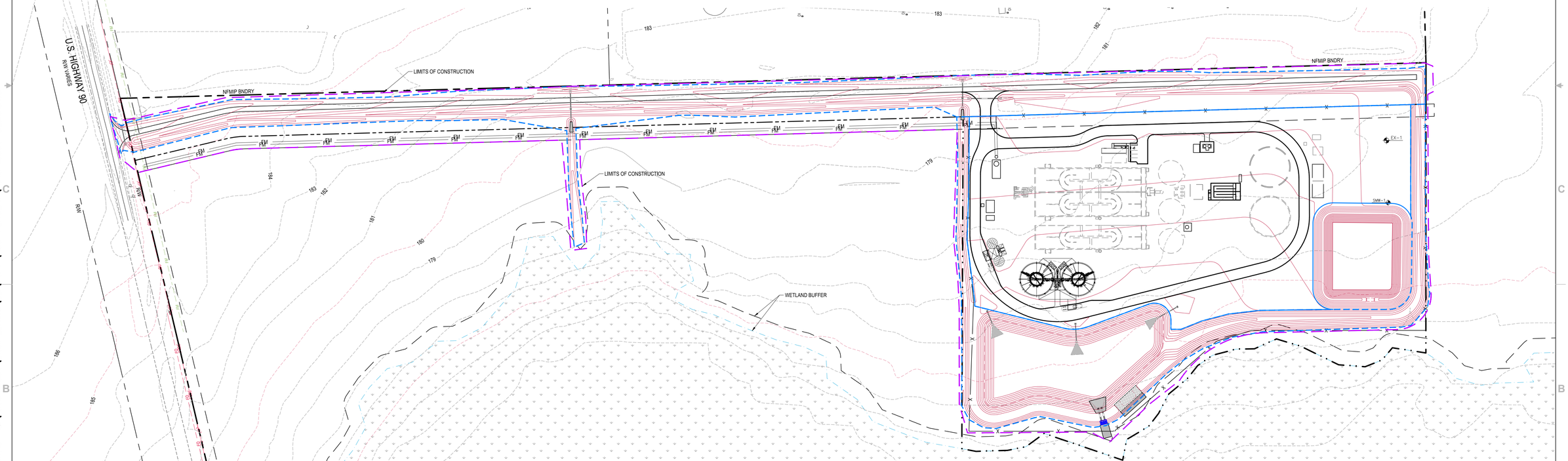
1. ALL CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE EACH WEEK AND FOLLOWING ANY STORM EVENT OF 0.50 INCHES OR GREATER.
2. ALL MEASURES SHALL BE MAINTAINED IN GOOD WORKING ORDER; IF A REPAIR IS NECESSARY, IT SHALL BE INITIATED WITHIN 24 HOURS OF REPORT.
3. BUILT UP SEDIMENT SHALL BE REMOVED FROM SILT FENCE WHEN IT HAS REACHED ONE-THIRD THE HEIGHT OF THE FENCE.
4. SILT FENCE SHALL BE INSPECTED FOR DEPTH OF SEDIMENT, TEARS, TO SEE IF THE FABRIC IS SECURELY ATTACHED TO THE FENCE POSTS, AND TO SEE THAT THE FENCE POSTS ARE FIRMLY IN THE GROUND.
5. TEMPORARY AND PERMANENT SEEDING AND PLANTING SHALL BE INSPECTED FOR BARE SPOTS, WASHOUTS, AND HEALTHY GROWTH.
6. A MAINTENANCE INSPECTION REPORT SHALL BE MADE AFTER EACH INSPECTION.
7. THE PROJECT SUPERINTENDENT, SHALL SELECT AN INDIVIDUALS WHO SHALL BE RESPONSIBLE FOR INSPECTIONS, MAINTENANCE AND REPAIR ACTIVITIES, AND FILLING OUT THE INSPECTION AND MAINTENANCE REPORT.
8. PERSONNEL SELECTED FOR INSPECTION AND MAINTENANCE RESPONSIBILITIES SHALL RECEIVE TRAINING FROM THE PROJECT SUPERINTENDENT. THEY SHALL BE TRAINED IN ALL THE INSPECTION AND MAINTENANCE PRACTICES NECESSARY FOR KEEPING THE EROSION AND SEDIMENT CONTROLS USED ONSITE IN GOOD WORKING ORDER.

TEMPORARY SEDIMENT SUMP NOTES:

1. CONTRACTOR TO INSPECT SEDIMENT SUMP WEEKLY AND AFTER RAIN EVENTS GREATER THAN ½". REMOVE SEDIMENT ACCUMULATION WHEN DEPTH EXCEEDS 6".
2. SEDIMENT BERMS AND SUMPS TO REMAIN UNTIL SUCH TIME THAT MAJOR EARTHWORK AND STORMWATER FACILITIES, INCLUDING CONVEYANCES AND OUTFALL STRUCTURES ARE COMPLETE. INLETS MUST BE PROTECTED WITH INLET PROTECTION PRIOR TO SUMP REMOVAL.
3. ACTUAL LOCATIONS AND CONFIGURATIONS OF TEMPORARY SEDIMENT BERMS/SUMPS MAY VARY DUE TO SITE CONDITIONS AND CONSTRUCTION PHASING AND SHALL BE COORDINATED WITH THE ENVIRONMENTAL INSPECTOR. BERMS/SUMPS SHALL BE SIZED TO PROVIDE FOR A MINIMUM VOLUME EQUAL TO 134 CY PER ACRE OF CONTRIBUTING AREA. SIZE OF SUMP MAY BE REDUCED WITH THE APPROVAL OF THE ENGINEER ONCE UPSTREAM AREAS ARE STABILIZED.

NOTES:

1. CONTRACTOR SHALL SUBMIT NOTICE OF CONSTRUCTION COMMENCEMENT TO THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT PRIOR TO ANY LAND CLEARING ACTIVITIES.
2. THE EROSION AND SEDIMENT CONTROLS SHOWN ON THE PLANS ARE THE MINIMUM REQUIRED. ADDITIONAL MEASURES MAY BE REQUIRED DEPENDING ON SITE CONDITIONS THROUGH THE PROJECT.
3. PERIMETER SILT FENCE TO BE INSTALLED PRIOR TO ANY OTHER EARTHWORK ACTIVITY.
4. IMPROVEMENTS ARE SHOWN FOR REFERENCE ONLY.
5. SILT FENCES ARE SHOWN OFF THE LIMITS OF CLEARING FOR CLARITY ONLY. THEY SHOULD BE LOCATED ON OR INSIDE THE LIMITS OF CLEARING LINE.
6. CONTRACTOR SHALL ENSURE THAT ALL INLETS ARE PROTECTED WITH INLET PROTECTION AS APPROPRIATE.
7. NO CONSTRUCTION TRAFFIC WILL BE PERMITTED TO ACCESS OR LEAVE THE SITE WITHOUT PASSING OVER THE TEMPORARY GRAVEL CONSTRUCTION ENTRANCE.
8. ON-SITE STORMWATER & EROSION CONTROL OFFICER TO BE NAMED AT PRE-CONSTRUCTION CONFERENCE.
9. WHEN NECESSARY, WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT TRAP OR BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH OR WATERCOURSE THROUGH THE USE OF SAND BAGS, GRAVEL, BOARDS OR OTHER APPROVED METHODS.
10. THE CONTRACTOR SHALL ENSURE THAT A FOREMAN OR SUPERVISOR WHO HAS BEEN CERTIFIED UNDER FLORIDA STORMWATER, EROSION AND SEDIMENTATION CONTROL INSPECTOR TRAINING PROGRAM IS AVAILABLE IN PERSON OR BY TELEPHONE AT ALL TIMES DURING CONSTRUCTION ACTIVITIES.
11. ALL DISTURBED AREAS TO BE LEFT IDLE LONGER THAN 14 DAYS MUST BE STABILIZED WITH QUICK GROW GRASS SEED AND MULCH.
12. CONTRACTOR SHALL PROVIDE STREET SWEEPING AS NECESSARY TO ENSURE ADJACENT ROADWAYS ARE SEDIMENT FREE. ADJACENT ROADWAYS SHALL BE MACHINE SWEPT WITHIN 24 HOURS OF SEDIMENT TRACKING.
13. ADEQUATE EROSION CONTROL MEASURES SHALL BE PROVIDED FOR STOCKPILE AREAS.
14. HYDROSEEDING MAY BE USED IN LIEU OF SEED & MULCH FOR STABILIZATION OF TEMPORARY SLOPES AND OTHER NON-SODDED DISTURBED AREAS. HYDROSEEDING SHALL BE PER FDOT STANDARD SPECIFICATION 570-3.4. ALL PERMANENT SLOPES 4:1 AND STEEPER SHALL BE SODDED IMMEDIATELY UPON CONSTRUCTION.
15. IF A CONCENTRATION OF PREHISTORIC OR HISTORIC ARTIFACTS, SUCH AS POTTERY OR CERAMICS, STONE TOOL OR METAL IMPLEMENTS, OR ANY OTHER PHYSICAL REMAIN THAT COULD BE ASSOCIATED WITH NATIVE AMERICAN CULTURES, EARLY COLONIAL, TERRITORIAL OR AMERICAN SETTLEMENTS ARE ENCOUNTERED AT ANY TIME WITHIN THE PROJECT AREA, THE PERMITTED PROJECT SHOULD CEASE ALL ACTIVITIES INVOLVING SURFACE DISTURBANCE IN THE IMMEDIATE VICINITY OF SUCH DISCOVERIES. THE APPLICANT, OR OTHER DESIGNEE, SHOULD CONTACT THE FLORIDA DEPARTMENT OF STATE, DIVISION OF HISTORICAL RESOURCES, COMPLIANCE AND REVIEW SECTION AT 850-245-6333, AS WELL AS THE APPROPRIATE PERMITTING AGENCY OFFICE. PROJECT ACTIVITIES SHOULD NOT RESUME WITHOUT VERBAL AND/OR WRITTEN AUTHORIZATION FROM THE DIVISION OF HISTORICAL RESOURCES. IN THE EVENT THAT UNMARKED HUMAN REMAINS ARE ENCOUNTERED DURING PERMITTED ACTIVITIES, ALL WORK SHALL STOP IMMEDIATELY AND THE PROPER AUTHORITIES NOTIFIED IN ACCORDANCE WITH SECTION 872.05, FLORIDA STATUTES.



CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES REQUIRED TO ENSURE SEDIMENTS FROM PROJECT SITE DO NOT REACH WETLAND AREAS. IF ANY SEDIMENT DO REACH THE WETLANDS THEY SHALL BE REMOVED BY CONTRACTOR IMMEDIATELY.

LTR.	DATE	REVISIONS	BY	APPRD.

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
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SEDIMENTATION AND EROSION CONTROL PLAN

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CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
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CONTRACTOR SHALL ENSURE 18' CLEARANCE FROM THE TOP OF PAVEMENT TO THE BOTTOM OF SAG IN ELECTRIC LINE AT THE DRIVEWAY CONNECTION. IF REQUIRED, ELECTRIC POLES MAY NEED TO BE RAISED TO PROVIDE REQUIRED CLEARANCE. IF POLES ARE TO BE RAISED, CONTRACTOR SHALL COORDINATE WITH WITH FLORIDA POWER & LIGHT (FPL) AND OTHER UTILITY PROVIDERS AS NEEDED.

NFMIP BNDRY

LIMITS OF CONSTRUCTION

TEMPORARY CONSTRUCTION ENTRANCE

PROPOSED R/W

30' PROPOSED UTILITY EASEMENT

STANDARD DUTY SILT FENCE

STAKED HAY BALE, TYP.

U.S. HIGHWAY 90
R/W VARIES

R/W

MATCHLINE (SHEET C6)

MATCHLINE (SHEET C7)

HEAVY DUTY SILT FENCE

CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES REQUIRED TO ENSURE SEDIMENTS FROM PROJECT SITE DO NOT REACH WETLAND AREAS. IF ANY SEDIMENT DO REACH THE WETLANDS THEY SHALL BE REMOVED BY CONTRACTOR IMMEDIATELY.

35' WETLAND BUFFER

EXISTING WETLANDS

NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

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NFMIP BNDRY

TYPE 'A' INLET PROTECTION

30' PROPOSED UTILITY EASEMENT

STANDARD DUTY SILT FENCE

STAKED HAY BALE, TYP.

PROPOSED R/W

30' PROPOSED UTILITY EASEMENT

EX-1

LIMITS OF CONSTRUCTION

MATCHLINE (SHEET C6)
(SHEET C7)

STANDARD DUTY SILT FENCE

SMW-1

DESIGNATED STOCKPILE AREA

APPROXIMATE STOCKPILE AREA TO BE PLACED IN 12" MAX. LIFTS. SEED AND MULCH ALL SLOPES EXPOSED FOR GREATER THAN 7 DAYS. EXACT SIZE AND LOCATION MAY VARY. COORDINATE WITH COUNTY ENGINEER (OR THEIR DESIGNEE). DOUBLE HEAVY DUTY SILT FENCE TO BE INSTALLED ON ALL DOWNHILL SIDES OF STOCKPILE AREA(S).

HEAVY DUTY SILT FENCE

DOUBLE ROW HEAVY DUTY SILT FENCE

EXCAVATE TEMPORARY SEDIMENT SUMP 2' LOWER THAN INLET TOP

EXCAVATE TEMPORARY SEDIMENT SUMP 2' LOWER THAN INLET TOP

TYPE 'A' INLET PROTECTION

TYPE 'A' INLET PROTECTION

EXCAVATE TEMPORARY SEDIMENT SUMP 2' LOWER THAN INLET TOP

TYPE 'A' INLET PROTECTION

HEAVY DUTY SILT FENCE

SOD FILL SLOPES ADJACENT TO WETLANDS IMMEDIATELY UPON CONSTRUCTION

LIMITS OF CONSTRUCTION

30' WETLAND BUFFER

EXISTING WETLANDS

HEAVY DUTY SILT FENCE

SOD FILL SLOPES ADJACENT TO WETLANDS IMMEDIATELY UPON CONSTRUCTION

EXISTING WETLANDS LINE, LOCATED BY OTHERS

CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES REQUIRED TO ENSURE SEDIMENTS FROM PROJECT SITE DO NOT REACH WETLAND AREAS. IF ANY SEDIMENT DO REACH THE WETLANDS THEY SHALL BE REMOVED BY CONTRACTOR IMMEDIATELY.

NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

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SEDIMENTATION AND EROSION CONTROL PLAN

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Amir Darabi,
State of Florida, Professional Engineer,
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805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO: C8

Jones Edmunds 2234

LEGEND

- ASPHALT PAVEMENT WITHIN FDOT R/W
- ON-SITE ASPHALT PAVEMENT
- PROPOSED GRAVEL DRIVE
- EXISTING WETLAND AREA

NORTH

GRAPHIC SCALE

0 60 120 240

1 inch = 120 ft.

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

NFMIP BNDRY

R= 197.00'
L= 40.52'
Δ= 11°47'04"

N 13°20'54" W 228.58'

S 01°33'50" E 3154.68'

N 01°33'50" W 1738.16'

30' PROPOSED UTILITY EASEMENT

100' PROPOSED R/W

100' PROPOSED R/W

30' PROPOSED UTILITY EASEMENT

N 01°33'50" W 1118.29'

U.S. HIGHWAY 90
(VAN VARES)

R/W

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

CONSERVATION AREA "D" WITH WETLANDS

EXISTING WETLANDS

PROPOSED SWMF

1.5 MG EFFLUENT STORAGE POND

SWMF-1

S 89°53'49" E 600.85'

N 89°33'36" W 425.89'

S 10°20'49" W 84.96'

S 01°45'51" E 75.82'

S 10°58'08" E 45.24'

S 36°10'35" E 54.77'

S 19°15'42" W 54.22'

S 79°06'46" E 50.65'

S 90°42'36" E 91.66'

S 62°13'32" E 53.10'

S 52°39'23" E 89.64'

S 29°33'47" E 58.29'

S 51°36'07" E 47.24'

S 34°39'13" E 43.91'

S 14°29'49" E 58.58'

S 01°01'01" E 43.99'

S 24°06'51" E 58.32'

S 16°56'18" W 62.23'

S 26°03'56" W 100.84'

S 84°12'02" W 64.17'

S 21°35'34" E 43.97'

S 49°50'56" E 38.74'

S 08°45'15" W 81.85'

EX-1

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NORTH FLORIDA MEGA INDUSTRIAL PARK WASTEWATER TREATMENT PLANT COLUMBIA COUNTY, FLORIDA

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GEOMETRY PLAN

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	C9

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NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

LEGEND

- ASPHALT PAVEMENT WITHIN FDOT R/W
- GRAVEL DRIVE
- WETLAND AREA

U.S. HIGHWAY 90
(R/W VARIES)

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXISTING EDGE OF PAVEMENT

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

NFMIP BNDRY

STOP SIGN

W/ STREET SIGN

R/W

MATCH EXISTING

ASPHALT PAVEMENT WITHIN FDOT R/W

R/W

N 13°20'54" W 228.55'

R= 197.00'
L= 40.52'
Δ= 11°47'04"

PROPOSED R/W

30' PROPOSED UTILITY EASEMENT

100' R/W

50'

28'

60'

12' WIDE GRAVEL ROAD

6' CHAIN LINK FENCE

S 01°33'50" E 3154.68'

N 01°33'50" W 1738.16'

30' PROPOSED UTILITY EASEMENT

SSS: STATE PRISONERS WORKING

SSS: TRUCKS ENTERING HIGHWAY

SSS: CABLE ROUTE - SOUTHERN BELL

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

35' WETLAND BUFFER

EXISTING WETLANDS

CONSERVATION AREA "D" WITH WETLANDS

(SHEET C9)

MATCHLINE (SHEET C10)

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NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

KEY BOX NOTE:

IFC 506.1 WHEN REQUIRED. "WHERE ACCESS TO OR WITHIN A STRUCTURE OR AN AREA IS RESTRICTED BECAUSE OF SECURED OPENINGS OR WHERE IMMEDIATE ACCESS IS NECESSARY FOR LIFE-SAVING OF FIRE-FIGHTING PURPOSES, THE FIRE CODE OFFICIAL IS AUTHORIZED TO REQUIRE A KEY BOX TO BE INSTALLED IN AN ACCESSIBLE LOCATION. THE KEY BOX SHALL BE OF AN APPROVED TYPE LISTED IN ACCORDANCE WITH UL 1037, AND SHALL CONTAIN KEYS TO GAIN ACCESS AS REQUIRED BY THE CODE OFFICIAL."

LEGEND

- ASPHALT PAVEMENT (SEE ON-SITE ASPHALT PAVEMENT DETAIL ON C-26)
- GRAVEL DRIVE
- WETLAND AREA
- CONCRETE AREA

6' CHAIN LINK FENCE
NFMIP BNDRY
STATION EQUATION 31+26.92 = 100+00
24" WHITE THERMOPLASTIC STOP BAR
STOP (R1-1)
CANTILEVERED SLIDING GATE (SEE JONES EDMUNDS PLANS FOR DETAILS)
KEY BOX (SEE NOTES ON THIS SHEET)
PROPOSED FENCE
PROPOSED R/W
20' PROPOSED UTILITY EASEMENT
30' PROPOSED UTILITY EASEMENT
100' R/W
WWTP SITE BNDRY
12" RIBBON CURB
DETAIL A
WASTE WATER TREATMENT FACILITY (SEE 'M' DRAWINGS)
1.5 MG EFFLUENT STORAGE POND
EX-1
SMW-1
PROPOSED SWMF
3,580' OF 6' CHAIN LINK PERIMETER FENCE (SEE JONES EDMUNDS PLANS FOR DETAILS)
35' WETLAND BUFFER
EXISTING WETLANDS
CONSERVATION AREA "D" WITH WETLANDS
(SHEET C9)
MATCHLINE (SHEET C10)

DETAIL A
1" = 10'

STOP SIGN AND STOP BAR PER MUTCD SPECS
LANDING (1.5% MAX)
RAMP (8.33% MAX)
30' MAX
MOBILE OFFICE / LAB TRAILER
REFER TO GEOTECHNICAL REPORTS FOR SOIL COMPACTION UNDER BUILDING. COVER COMPACTED AREA WITH #57 STONE
FUTURE ADMINISTRATIVE BUILDING

HANDICAPPED PARKING
NOT TO SCALE

NOTE: BLUE STRIPE IS TO BE ON THE INSIDE OF H.C. PARKING SPACE
REGULAR SPACES
HC SPACE
4" BLUE STRIPING @ 45° ON 24" CENTERS TO INDICATE NO PARKING ZONE PER A.D.A. SPECIFICATIONS
4" TRAFFIC WHITE (TYP.)
ALL RAMPS SHALL MEET A.D.A. STANDARDS
FLUSH
RAMP 12:1
FLAT
RAISED SIDEWALK AS SHOWN ON PLANS
HANDICAP PARKING SIGN @ EACH SPACE PER DETAIL
RAMP AS SHOWN ON GRADING PLAN AS REQ'D FOR H/C ACCESSIBILITY (@ EA. SPACE)

HANDICAPPED PARKING SIGNAGE
NOT TO SCALE

FIGURE "A"
PARKING BY DISABLED PERMIT ONLY
$250 FINE

- TOP PORTION OF FIGURE "A" AND "B" SHALL HAVE A REFLECTIVE BLUE BACKGROUND WITH WHITE REFLECTIVE SYMBOL AND BORDER.
- BOTTOM PORTION OF FIGURE "A" AND "B" SHALL HAVE A REFLECTIVE WHITE BACKGROUND WITH BLACK OPAQUE LEGEND AND BORDER.
- FIGURE "A" AND "B" MAY BE FABRICATED ON ONE PANEL OR TWO.
- FIGURE A" MAY BE SUBSTITUTED FOR FIGURE "B" IN AREAS WHERE SPACE IS LIMITED.
- SIGNS ARE TO BE MOUNTED AT STANDARD HEIGHT.(7 FT. FROM PAVEMENT TO BOTTOM OF SIGN.)

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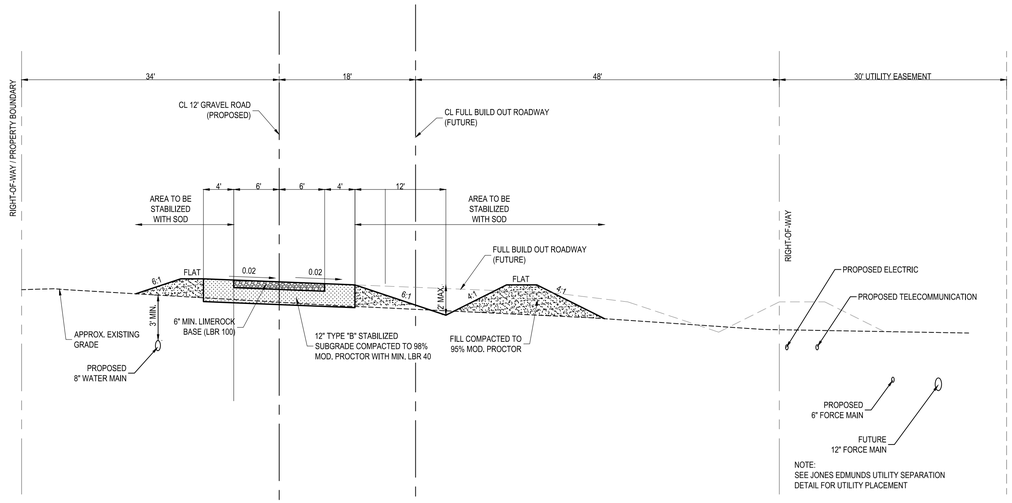
GEOMETRY PLAN

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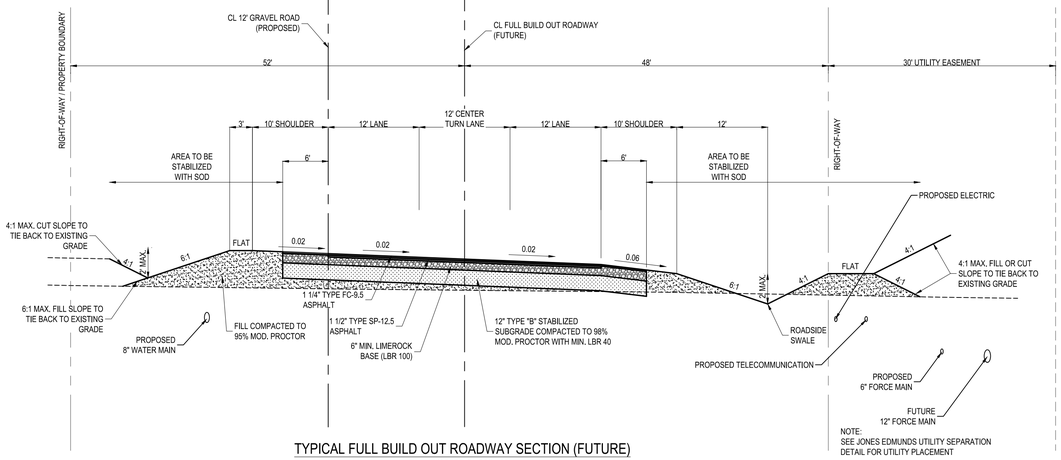
PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
DWG NO: C11

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TYPICAL 12' GRAVEL ROAD SECTION (PROPOSED)
1" = 10' HORIZONTAL
1" = 5' VERTICAL

NOTE: CONFIGURATION OF "TYPICAL 12' GRAVEL ROAD SECTION" PROVIDED BY COLUMBIA COUNTY.



TYPICAL FULL BUILD OUT ROADWAY SECTION (FUTURE)
1" = 10' HORIZONTAL
1" = 5' VERTICAL

NOTE: THIS FULL BUILD-OUT ROADWAY SECTION DEPICTS A FUTURE CONDITION OF THE ROADWAY FOR REFERENCE ONLY. THIS SECTION IS NOT A PART OF THIS PROJECT.

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TYPICAL SECTION SHEET

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PROJECT NO:	DATE:
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	C12

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NORTH

GRAPHIC SCALE

0 60 120 240

1 inch = 120 ft.

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

NFMIP BNDRY

PROPOSED CROSS DRAIN

U.S. HIGHWAY 90 (RW VARIES)

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

30' PROPOSED UTILITY EASEMENT

100' PROPOSED R/W

100' PROPOSED R/W

NFMIP BNDRY

30' PROPOSED UTILITY EASEMENT

WWTP SITE BNDRY

WWTP SITE BNDRY

EX-1

SWM-1

179.0

179.0

1.5 MG EFFLUENT STORAGE POND

PROPOSED SWMF

CONSERVATION AREA "D" WITH WETLANDS

RW

RW

RW

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GRADING PLAN

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NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

US 90 R/W

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

EXISTING EDGE OF PAVEMENT

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

FCM 4"X4" 1428

NFMIP BNDRY

TBM ELEV: 187.02

MES INV.: 185.85'

18" RCP

46 LF OF 18" RCP CROSS DRAIN @ 0.55%

MES INV.: 185.60'

TBM ELEV: 184.03

30' UTILITY EASEMENT

46 LF OF 14" X 23" ELLIPTICAL RCP CROSS DRAIN @ 4.10%

MES INV.: 180.00

TBM ELEV: 181.20

F.F. 2

31 LF OF 18" RCP @ 0.75%

MES INV.: 177.65

S-4
CONST. INLET TYPE E
INDEX NO.: 425-052
GRATE: 182.07'
INV. IN: 178.12'
INV. OUT: 178.12'
CONST. ALUMINUM SKIMMER
PER FDOT INDEX #425-070 TOP: 182.50'

SSS: STATE PRISONERS WORKING

SSS: TRUCKS ENTERING HIGHWAY

SSS: CABLE ROUTE - SOUTHERN BELL

FIRC 5/8" F.D.O.T.

U.S. HIGHWAY 90 (FKN VARIES)

US 90 R/W

US 90 (FKN) R/W

35' WETLAND BUFFER

EXISTING WETLANDS

(SHEET C13)

MATCHLINE (SHEET C14)

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DATE: APRIL 2022
INDEX NO:
DWG NO: C14

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NORTH

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

MATCHLINE (SHEET C14)

(SHEET C13)

S-5
CONST. INLET TYPE C
INDEX NO.: 425-052
GRATE: 181.00'
INV. IN: 177.50'
INV. OUT: 177.50'
CONST. ALUMINUM SKIMMER
PER FDOT INDEX #425-070 TOP: 181.50

46 LF OF 14" X 23" ERCP @ 4.93%

MES INV.: 179.75

MES INV.: 179.40

MES INV.: 179.40

82 LF OF 14" X 23" ERCP @ 0.00%

18" RCP @ 0.50%

MES INV.: 177.36

NFMIP BNDRY

3,580' OF 6' CHAIN LINK PERIMETER FENCE (SEE JONES EDMUNDS PLANS FOR DETAILS)

FCM 4"X4" 4432

TBM ELEV: 177.13

WWTP SITE BNDRY

EX-1

DETAIL A

TOP OF SLAB EL.: 181.00

TOP OF SLAB EL.: 181.00

REFER TO STRUCTURAL PLANS FOR PAD AND WALL ELEVATIONS

SMW-1

1.5 MG EFFLUENT STORAGE POND

5' MAINTENANCE BERM

TOP OF SLAB EL.: 179.50

TOP OF SLAB EL.: 179.50

TOP OF SLAB EL.: 179.00

TOP OF SLAB EL.: 179.00

TOP OF SLAB EL.: 178.50

S-1
CONST. INLET TYPE C
INDEX NO.: 425-052
GRATE: 176.50'
INV. OUT: 171.00'

S-3
CONST. INLET TYPE C
INDEX NO.: 425-052
GRATE: 176.50'
INV. OUT: 173.00'

60 LF 18" HP STORM @ 8.35%

40 LF 18" HP STORM @ 7.50%

MES INV.: 168.00

50 LF 18" HP STORM @ 10.20%

MES INV.: 168.00

MES INV.: 168.00

S-2
CONST. INLET TYPE C
INDEX NO.: 425-052
GRATE: 176.50'
INV. OUT: 173.00'

SWMF

SPILLWAY SEE SWMF DETAIL SHEET

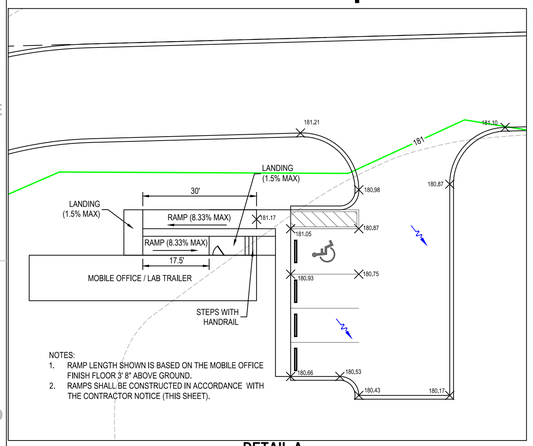
CS-1 AND CS-2 SEE SWMF DETAIL SHEET

20' MAINT BERM

30' MAINT BERM

50' WETLAND BUFFER

EXISTING WETLANDS



NOTES:
1. RAMP LENGTH SHOWN IS BASED ON THE MOBILE OFFICE FINISH FLOOR 3' 8" ABOVE GROUND.
2. RAMPS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CONTRACTOR NOTICE (THIS SHEET).

DETAIL A
1" = 10'

CONTRACTOR NOTICE

THE CONTRACTOR & OWNER WILL BE HELD ACCOUNTABLE DURING CONSTRUCTION FOR ALL SITE IMPROVEMENTS. COMPLIANCE WITH FLORIDA STATUTES 553.5041 (F.S.), AND THE ***2020 FLORIDA BUILDING CODE, ACCESSIBILITY, 7TH EDITION*** (FBC-A), IS MANDATORY. IF NON-COMPLIANT AT FINAL INSPECTION, CONTRACTOR WILL BE REQUIRED TO MODIFY CONSTRUCTION TO COMPLY WITH F.S. AND FBC-A. THE FOLLOWING ITEMS TAKE PRECEDENCE AND SUPERSEDE OTHER SITE DETAILS ON DRAWINGS:

1. ACCESSIBLE PARKING SPACES SHALL BE LOCATED ON AN ACCESSIBLE ROUTE NO LESS THAN 44" WIDE SO THAT USERS WILL NOT BE COMPELLED TO WALK OR WHEEL BEHIND PARKED VEHICLES EXCEPT BEHIND HIS OR HER OWN VEHICLE. §208.1 AND §502.3, FBC-A AND F.S. 553.5041.
2. ACCESSIBLE PARKING SPACES AND ACCESS AISLES SERVING A PARTICULAR BUILDING SHALL BE LOCATED ON THE SHORTEST ACCESSIBLE ROUTE FROM THE ACCESSIBLE (H/C) PARKING TO AN ACCESSIBLE ENTRANCE. §208.3.1 FBC-A AND F.S. 553.5041(5)(B).
3. ACCESSIBLE PARKING SPACES SHALL BE 12' WIDE, AND OUTLINED WITH BLUE PAINT. §502.2 AND §502.6, FBC-A
4. ACCESS AISLES REQUIRED ADJACENT TO PARKING SPACES SHALL BE 5' WIDE WITH DIAGONAL STRIPING. §502., FBC-A
5. ACCESSIBLE PARKING AND ACCESS AISLES SHALL BE LEVEL (NOT TO EXCEED 1:48) ON A STABLE, FIRM & SLIP RESISTANT SURFACE. RE: §302.1, §502.3. FBC-A
6. ACCESSIBLE PARKING SIGNS SHALL BE FDOT APPROVED AND SHALL READ 'PARKING BY DISABLED PERMIT ONLY' AND SHALL INDICATE A $250 FINE FOR ILLEGAL USE. INSTALL SIGNS A MINIMUM 60" (INCHES) FROM THE GROUND TO THE BOTTOM OF THE SIGN(S). RE: §502.6 AND F.S 553.5041.
7. CURB RAMPS SHALL NOT EXCEED 1:12 SLOPE, AND CURB RAMP FLARES SHALL NOT EXCEED 1:10 SLOPE. CURB RAMPS AND FLARED SIDES SHALL NOT ENCROACH UPON PARKING SPACES, ACCESS AISLES, OR VEHICULAR TRAFFIC LANES. THE COUNTER SLOPE OF ADJACENT ROAD SURFACES & GUTTERS SHALL NOT EXCEED 1:20. RE: §405.2, §406., FBC-A
8. CURB RAMPS SHALL HAVE A LANDING WITH A MINIMUM CLEAR LENGTH OF 36" SHALL BE LOCATED AT THE TOP SIDE OF EACH CURB RAMP, A CLEAR WIDTH AT LEAST AS WIDE AS THE CURB RAMP (EXCLUDING FLARED SIDES) LEADING TO IT. EXCEPTION: FOR ALTERATIONS, WHERE THERE IS NO LANDING, CURB RAMP FLARES SHALL BE PROVIDED, AND SHALL NOT BE STEEPER THAN 1:12 SLOPE. RE: §406, FBC-A
9. ALL RAMPS WITH A RISE GREATER THAN 6" SHALL PROVIDE EDGE PROTECTION COMPLYING WITH §405.9 FACBC. RAMPS SHALL HAVE 60" MIN LEVEL LANDINGS AT THE TOP & BOTTOM. RE: §405.7. FBC-A.
10. ALL RAMPS WITH A RISE GREATER THAN 6" SHALL HAVE HANDRAILS ON BOTH SIDES WITH 12" HORIZONTAL EXTENSIONS AT THE TOP & BOTTOM OF THE RAMP. RE: §1010.9 FBC-B (FLORIDA BUILDING CODE - BUILDING) AND §505.10 FBC-A.
11. ACCESSIBLE ROUTES TO "MAIN ENTRY" FROM AN ACCESSIBLE PARKING SPACE, AND FROM THE "PUBLIC WAY", SHALL NOT EXCEED 1:20 SLOPE (UNLESS RAMPS, HANDRAILS WITH PROPER EXTENSIONS ARE PROVIDED) WITH CROSS SLOPE NOT IN EXCESS OF 1:48. RE: §206, §402 AND §403., FBC-A.
12. *CONNECT BUILDINGS WITHIN THE SAME SITE WITH AN ACCESSIBLE ROUTE WHICH SHALL NOT EXCEED 1:20 SLOPE (UNLESS RAMPS AND HANDRAILS ARE PROVIDED) AND A MAXIMUM CROSS SLOPE OF 1:48. RE: §206 FBC-A.

* **EXCEPTION:** AN ACCESSIBLE ROUTE SHALL NOT BE REQUIRED BETWEEN ACCESSIBLE BUILDINGS, ACCESSIBLE FACILITIES, ACCESSIBLE ELEMENTS, AND ACCESSIBLE SPACES IF THE ONLY MEANS OF ACCESS BETWEEN THEM IS A VEHICULAR WAY NOT PROVIDING PEDESTRIAN ACCESS. RE: §206.2.2 FBC-A

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State of Florida, Professional Engineer,
License No. 68298

805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
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INDEX NO:	DWG NO: C15

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GRAPHIC SCALE

0 20 40 80

1 inch = 40 ft.

EXCLUSIVE UTILITY EASEMENT OR BOOK 1268, PAGE 1537

NFMIP BNDRY

GAS PIPELINE MARKER

8" GATE VALVE PER COLUMBIA COUNTY SPEC.S

TIE TO EXIST. WATER MAIN PER COLUMBIA COUNTY SPEC.S

PROPOSED 8" WATER MAIN (MAINTAIN 3' COVER)

U.S. HIGHWAY 90
R/W VARIES

100' R/W

30' UTILITY EASEMENT

FUTURE 12" SEWER FORCEMAIN

PROPOSED 6" SEWER FORCEMAIN

PROPOSED UNDERGROUND ELECTRIC

PROPOSED UNDERGROUND TELECOMMUNICATION

NOTES:
1. EXISTING UTILITY LAYOUT BASED ON SOFT-DIG DATA PROVIDED BY CARDNO TBE FROM TESTING LOCATIONS ALONG NFMIP NORTHERN BOUNDARY IN AREAS WEST OF TYRE ROAD.
2. EXISTING UTILITY LOCATIONS AT PROPOSED UTILITY CONNECTIONS TO BE VERIFIED IN FINAL DESIGN.

EXISTING FIRE HYDRANT WITH WATER VALVES,(2)

25' RIGHT-OF-WAY EASEMENT FOR PUBLIC UTILITIES OR BOOK 827, PAGE 2338

MAINTAIN 3' MIN. COVER TROUGH DITCH CROSSING. INSTALL AIR RELIEF VALVES PER JONES EDMONDS SPECS.

MAINTAIN 3' MIN. COVER TROUGH DITCH CROSSING. INSTALL AIR RELIEF VALVES PER JONES EDMONDS SPECS.

MATCHLINE

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GRAPHIC SCALE

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1 inch = 40 ft.

GATE VALVE PER COLUMBIA COUNTY SPECS

6' CHAIN LINK FENCE

NFMIP BNDRY

PROPOSED 6" WATER MAIN

FIRE HYDRANT ASSEMBLY PER COLUMBIA COUNTY SPECS

FUTURE 12" SEWER FORCEMAIN

PROPOSED 6" SEWER FORCEMAIN

PROPOSED UNDERGROUND TELECOMMUNICATION

PROPOSED UNDERGROUND ELECTRIC

WATER SERVICE W/ BACKFLOW PER JONES EDMUNDS SPECS (FOR CONTINUATION SEE SHEETS M-2 AND M-3)

MASTER MANHOLE PER JONES EDMUNDS SPECS

FIRE HYDRANT PER JONES EDMUNDS SPECS

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

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UTILITY PLAN

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NORTH

GRAPHIC SCALE

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GATE VALVE PER COLUMBIA COUNTY SPECS

6' CHAIN LINK FENCE

NFMIP BNDRY

PROPOSED 8" WATER MAIN

GATE VALVE PER COLUMBIA COUNTY SPECS

FLUSH VALVE PER COLUMBIA COUNTY SPECS

FIRE HYDRANT ASSEMBLY PER COLUMBIA COUNTY SPECS

WATER SERVICE W/ BACKFLOW PER JONES EDMUNDS SPECS (FOR CONTINUATION SEE SHEETS M-2 AND M-3)

102' R/W

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

30' UTILITY EASEMENT

FUTURE UNDERGROUND ELECTRIC

FUTURE UNDERGROUND TELECOMMUNICATION

MASTER MANHOLE PER JONES EDMUNDS SPECS

FIRE HYDRANT PER JONES EDMUNDS SPECS

EX-1

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

WASTE WATER TREATMENT FACILITY (SEE M SHEETS)

WWTP SITE BNDRY

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

FIRE HYDRANT PER JONES EDMUNDS SPECS

SMW-1

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

FIRE HYDRANT PER JONES EDMUNDS SPECS

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

WATER SERVICE PER JONES EDMUNDS SPECS (SEE SHEETS M-2 AND M-3)

WWTP SITE BNDRY

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UTILITY PLAN

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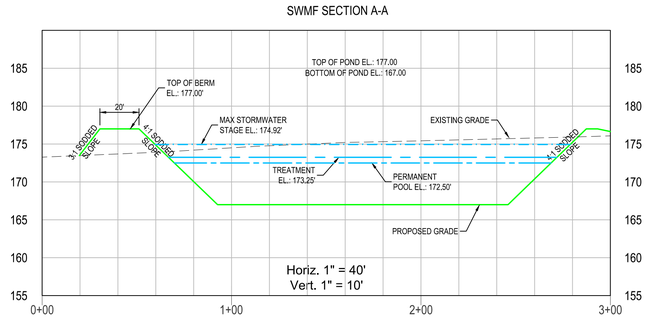
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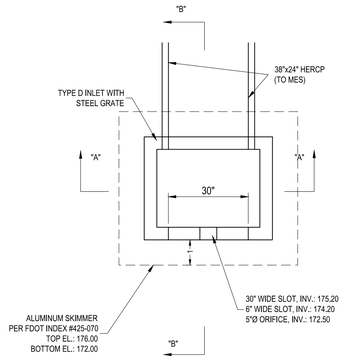
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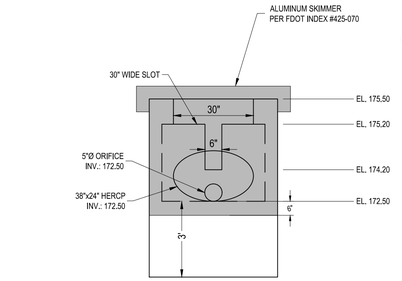
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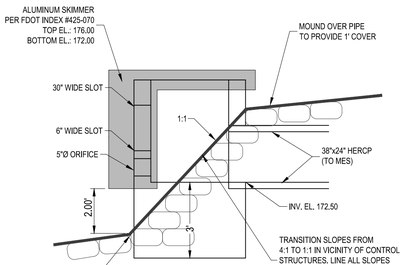


PLAN VIEW



NOTE: CS #1 AND CS #2 ARE IDENTICAL STRUCTURES.

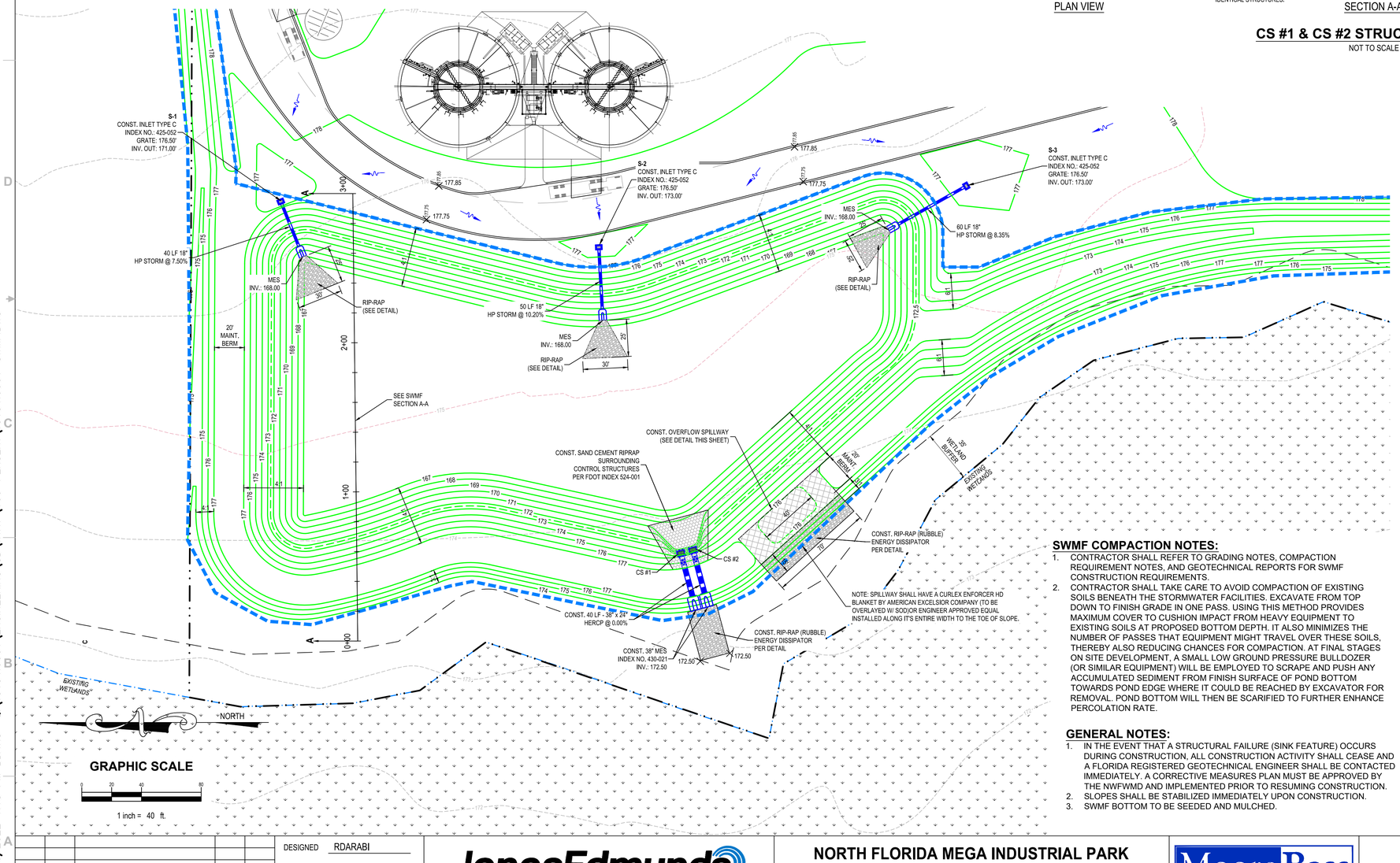
SECTION A-A



SECTION B-B

CS #1 & CS #2 STRUCTURE DETAILS

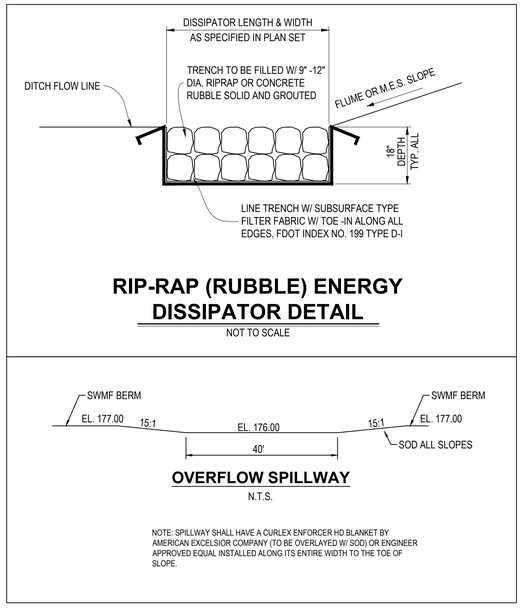
NOT TO SCALE



GRAPHIC SCALE

0 20 40 80

1 inch = 40 ft.



RIP-RAP (RUBBLE) ENERGY DISSIPATOR DETAIL

NOT TO SCALE

OVERFLOW SPILLWAY

N.T.S.

NOTE: SPILLWAY SHALL HAVE A CURLEX ENFORCER HD BLANKET BY AMERICAN EXCELSIOR COMPANY (TO BE OVERLAYED W/ SOD) OR ENGINEER APPROVED EQUAL INSTALLED ALONG ITS ENTIRE WIDTH TO THE TOE OF SLOPE.

SWMF COMPACTION NOTES:

1. CONTRACTOR SHALL REFER TO GRADING NOTES, COMPACTION REQUIREMENT NOTES, AND GEOTECHNICAL REPORTS FOR SWMF CONSTRUCTION REQUIREMENTS.
2. CONTRACTOR SHALL TAKE CARE TO AVOID COMPACTION OF EXISTING SOILS BENEATH THE STORMWATER FACILITIES. EXCAVATE FROM TOP DOWN TO FINISH GRADE IN ONE PASS. USING THIS METHOD PROVIDES MAXIMUM COVER TO CUSHION IMPACT FROM HEAVY EQUIPMENT TO EXISTING SOILS AT PROPOSED BOTTOM DEPTH. IT ALSO MINIMIZES THE NUMBER OF PASSES THAT EQUIPMENT MIGHT TRAVEL OVER THESE SOILS, THEREBY ALSO REDUCING CHANCES FOR COMPACTION. AT FINAL STAGES ON SITE DEVELOPMENT, A SMALL LOW GROUND PRESSURE BULLDOZER (OR SIMILAR EQUIPMENT) WILL BE EMPLOYED TO SCRAPE AND PUSH ANY ACCUMULATED SEDIMENT FROM FINISH SURFACE OF POND BOTTOM TOWARDS POND EDGE WHERE IT COULD BE REACHED BY EXCAVATOR FOR REMOVAL. POND BOTTOM WILL THEN BE SCARIFIED TO FURTHER ENHANCE PERCOLATION RATE.

GENERAL NOTES:

1. IN THE EVENT THAT A STRUCTURAL FAILURE (SINK FEATURE) OCCURS DURING CONSTRUCTION, ALL CONSTRUCTION ACTIVITY SHALL CEASE AND A FLORIDA REGISTERED GEOTECHNICAL ENGINEER SHALL BE CONTACTED IMMEDIATELY. A CORRECTIVE MEASURES PLAN MUST BE APPROVED BY THE NWFWMD AND IMPLEMENTED PRIOR TO RESUMING CONSTRUCTION.
2. SLOPES SHALL BE STABILIZED IMMEDIATELY UPON CONSTRUCTION.
3. SWMF BOTTOM TO BE SEEDED AND MULCHED.

SOD NOTES:

1. SOD SHALL BE LAPPED AND PINNED ON ALL SLOPES OF 1:2(V:H) OR STEEPER IN THE FOLLOWING MANNER:
2. PLACE THE SOD ON THE PREPARED SURFACE AND STAGGER THE SOD PIECES TO AVOID A CONTINUOUS SEAM ALONG THE LINE OF FLOW. START AT THE BOTTOM OF THE SLOPE BREAK POINT AND WORK UP TO THE TOP OF THE SLOPE BREAK POINT, WITH THE UPPER ROW OF SOD OVERLAPPING THE LOWER ROW OF SOD BY 3 INCHES. EMBED SOD FIRMLY AND SMOOTHLY BY LIGHT TAMPING WITH APPROPRIATE TOOLS. INSTALL SOD PINS IN THE OVERLAP LOCATIONS, WITH NOT LESS THAN FOUR PINS PER SQUARE YARD AND AT LEAST ONE PIN FOR EACH PIECE OF SOD. PINS SHALL BE A MINIMUM OF 6 INCHES LONG AND SHALL BE INSTALLED SO THAT THEY HOLD THE SOD FIRMLY IN PLACE YET PRESENT NO DANGER TO PEDESTRIANS OR MOWING CREWS. THE TYPE OF PIN AND THE METHOD OF INSTALLATION SHALL MEET THE APPROVAL OF THE ENGINEER OR LANDSCAPE ARCHITECT.
3. ALL SOD ASSOCIATED WITH THE STORMWATER FACILITY SHALL BE PINNED. LAPPING IS NOT REQUIRED ON SLOPES 1:3 (V:H) OR FLATTER.
4. AT PROJECT CLOSE OUT, SOD MUST BE ROOTED AND WELL ESTABLISHED. DURING CONSTRUCTION, SOD SHOULD BE MONITORED FOR SLIPPAGE AND EROSION. IF EITHER OF THESE CONDITIONS OCCUR, CORRECTIVE ACTION SHALL BE IMMEDIATELY TAKEN.
5. DO NOT USE SOD WHICH HAS BEEN CUT FOR MORE THAN 48 HOURS.

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SWMF DETAIL SHEET

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EX-1

SMW-1

1.5 MG EFFLUENT STORAGE POND

5' MAINTENANCE BERM

OVERFLOW SPILLWAY (SEE DETAIL)

EXISTING WETLANDS

15' WETLAND BUFFER

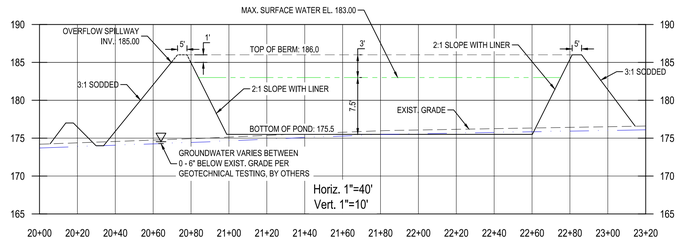
NORTH

GRAPHIC SCALE

0 20 40 80

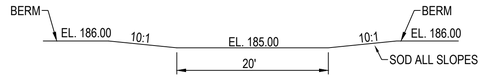
1 inch = 40 ft.

EFFLUENT STORAGE POND SECTION B-B



EFFLUENT STORAGE POND NOTES:

1. PERIMETER BERM SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATIONS PROVIDED IN THE GEOTECHNICAL REPORT (BY OTHERS).
2. THE CONTRACTOR SHALL FURNISH AND INSTALL A GEOMEMBRANE LINER SYSTEM CONSISTING OF A PRIMARY, SECONDARY, AND GEOSYNTHETIC CLAY LAYER PROTECTIVE 40-MIL, TEXTURED, HIGH-DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE AS SPECIFIED IN SPECIFICATION SECTION 02071 BY JONES EDMUNDS.
3. SEE SHEET M-18 FOR LINER DETAILS.



OVERFLOW SPILLWAY

N.T.S.

NOTE: SPILLWAY SHALL HAVE A CURLEX ENFORCER HD BLANKET BY AMERICAN EXCELSIOR COMPANY (TO BE OVERLAYED W/ SOD) OR ENGINEER APPROVED EQUAL INSTALLED ALONG ITS ENTIRE WIDTH TO THE TOE OF SLOPE.

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EFFLUENT POND DETAIL SHEET

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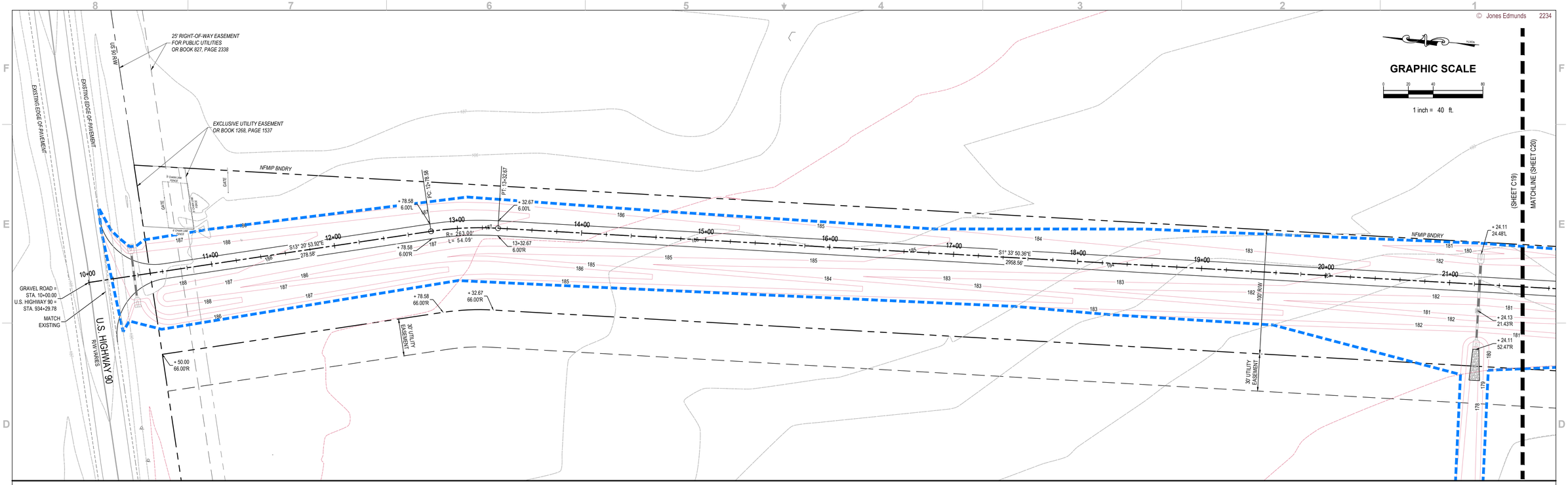
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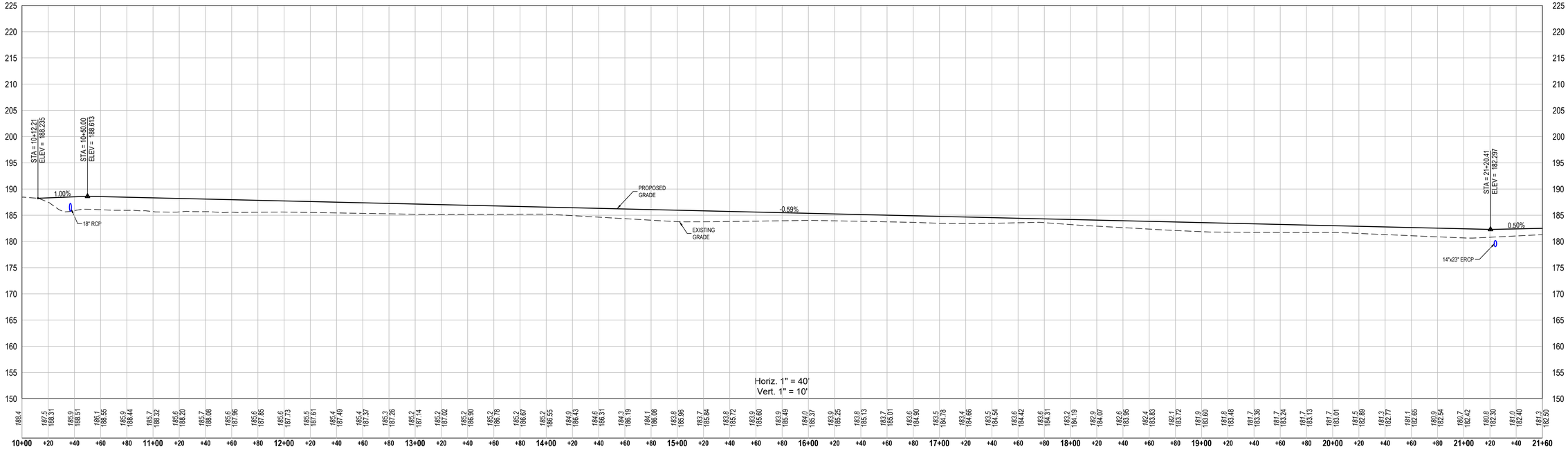
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12' GRAVEL ROAD (1) Profile



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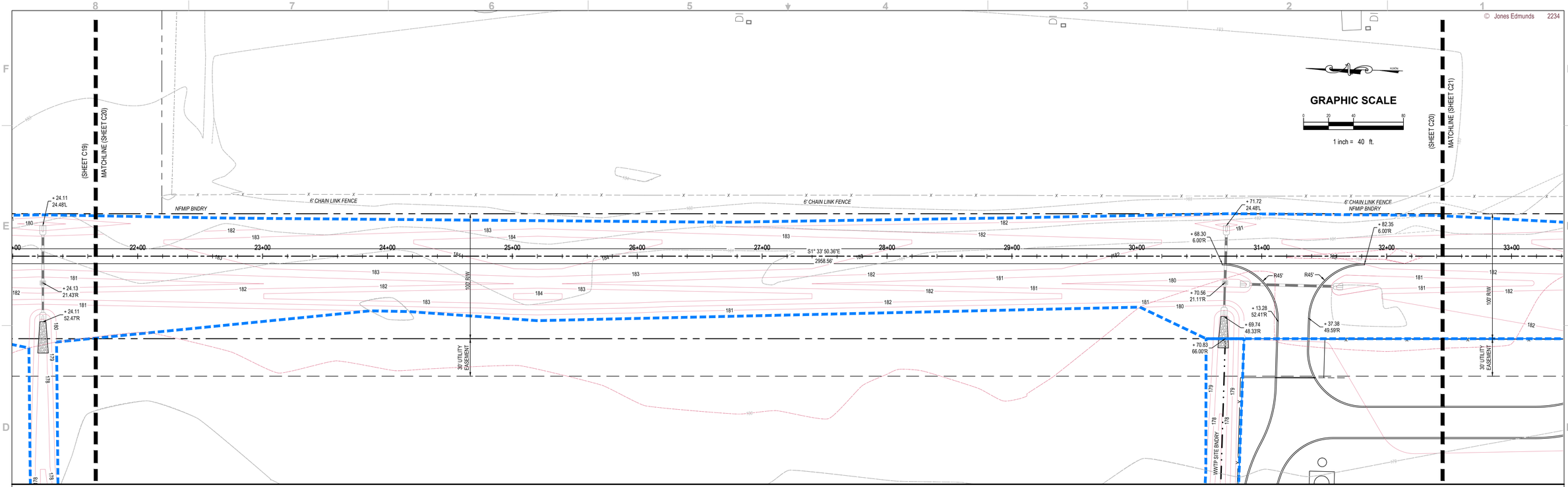
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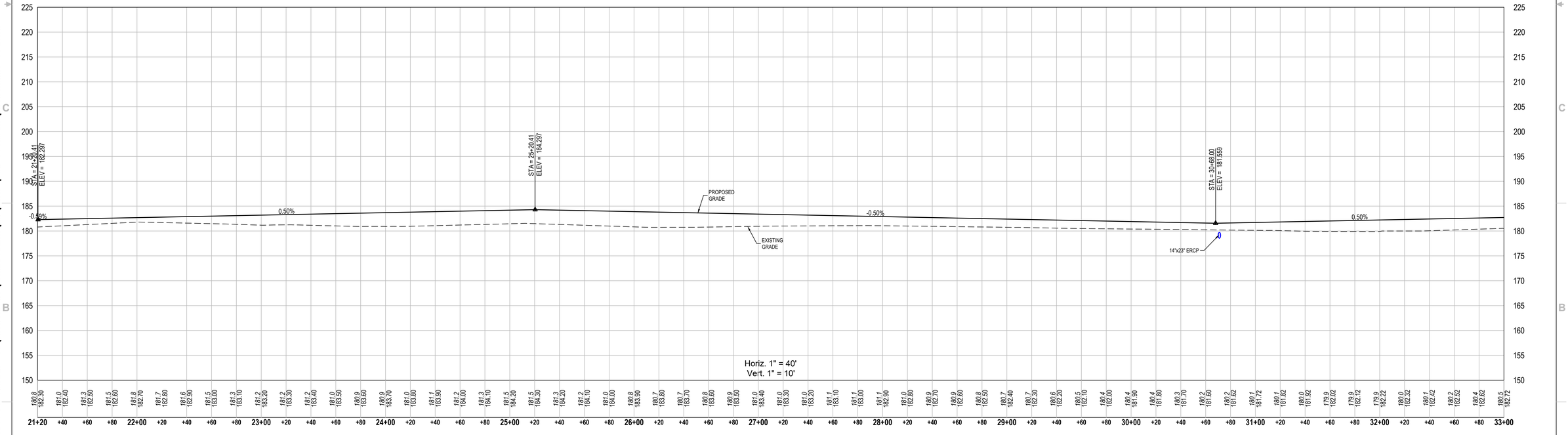
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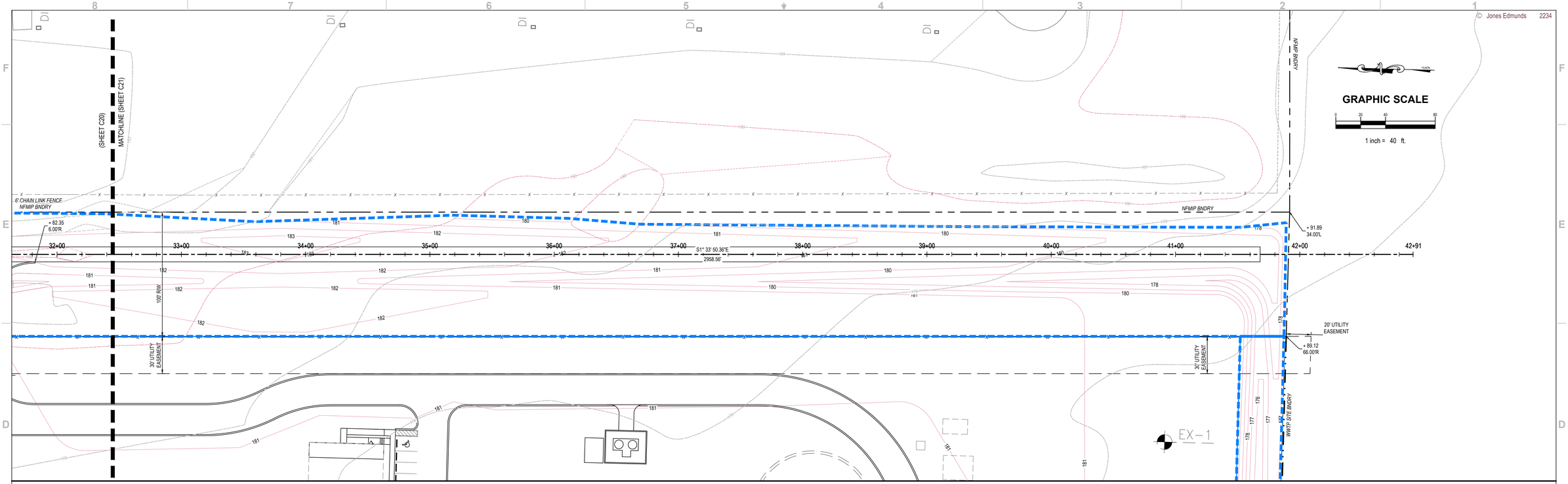
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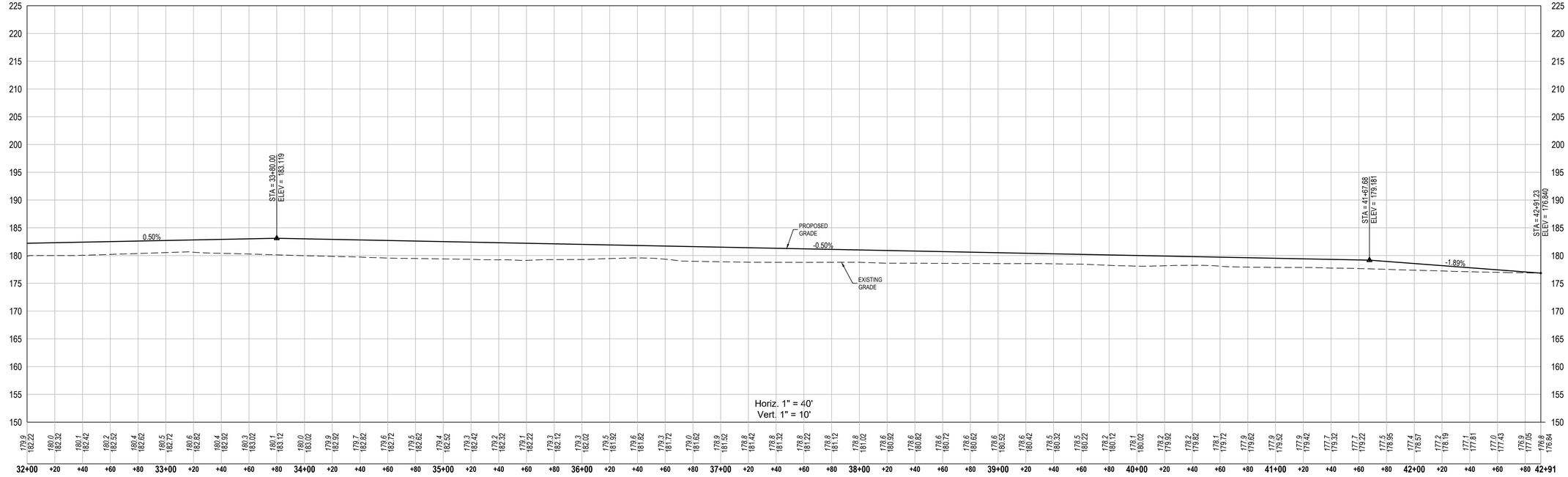
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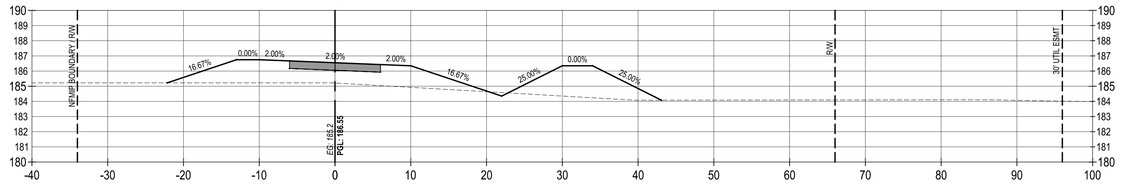
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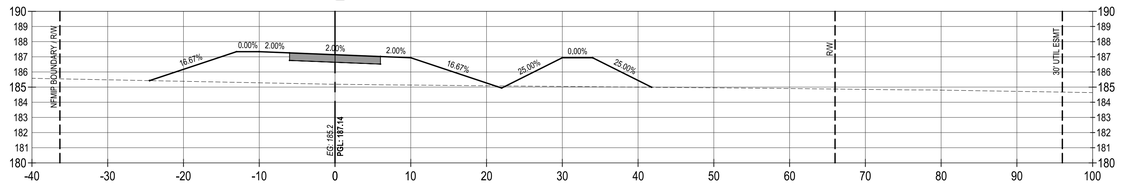
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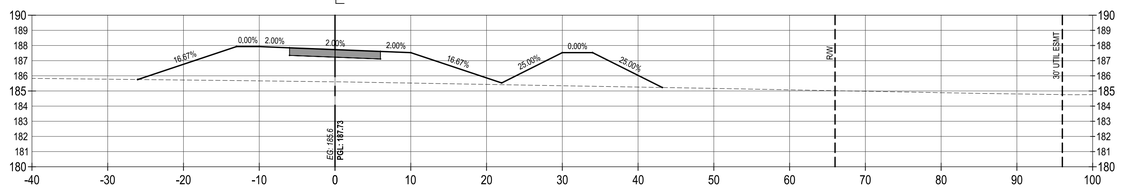
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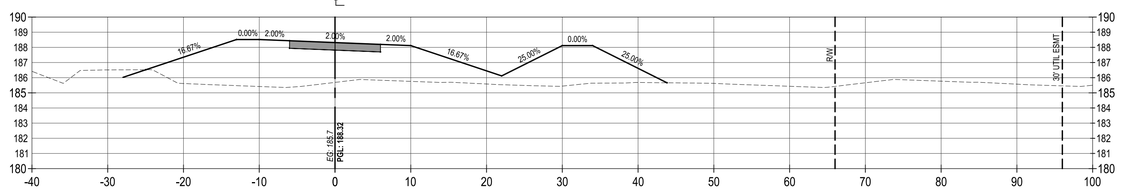
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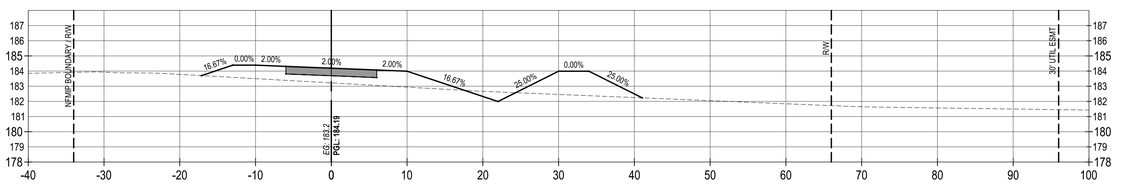
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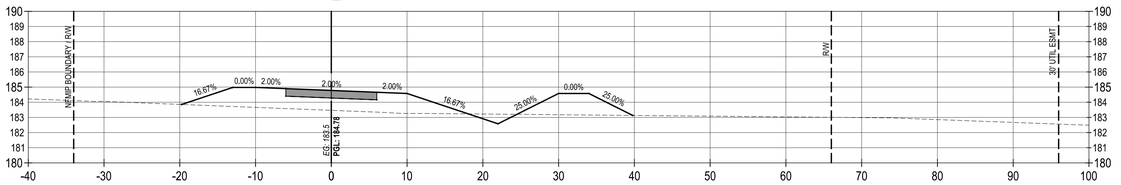
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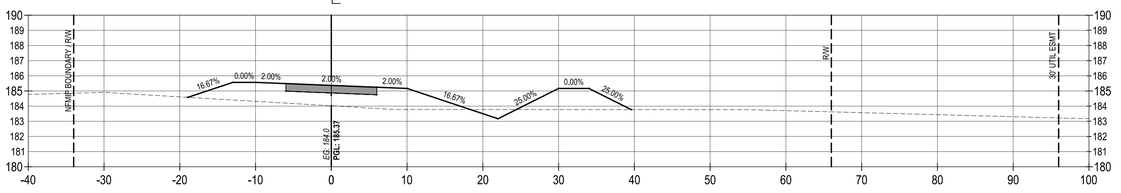
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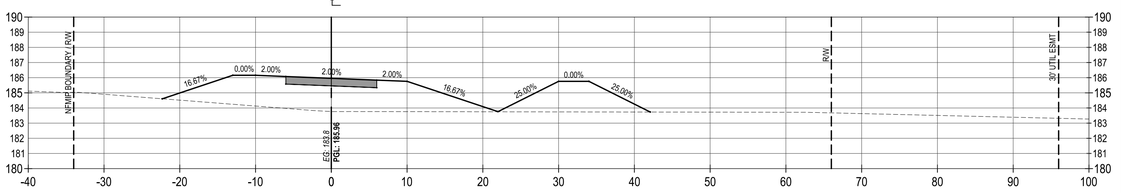
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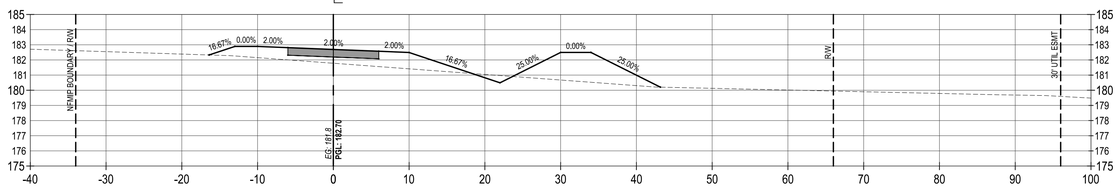
Amir Darabi,
State of Florida, Professional Engineer,
License No. 68298

805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

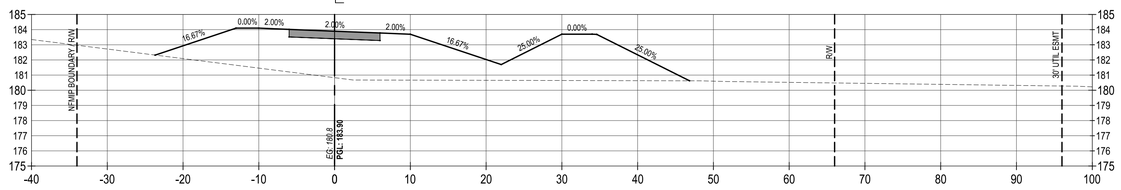
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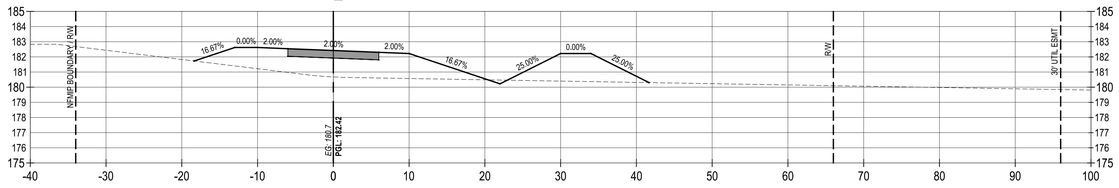
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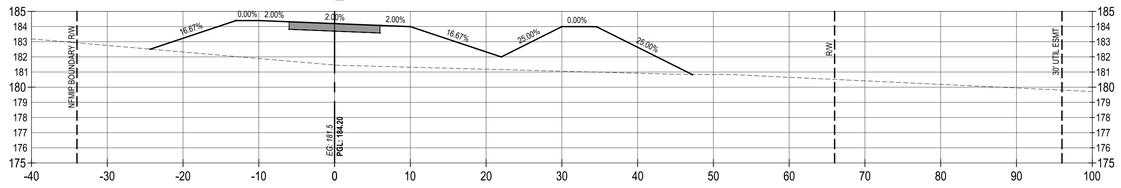
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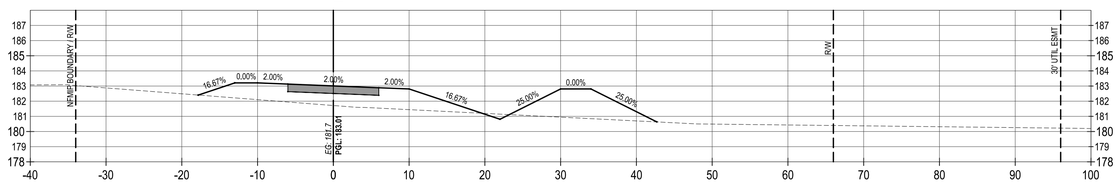
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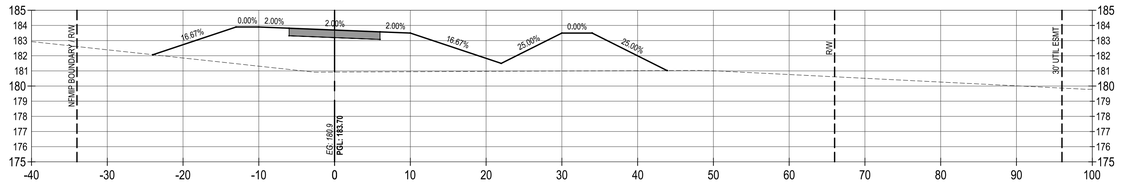
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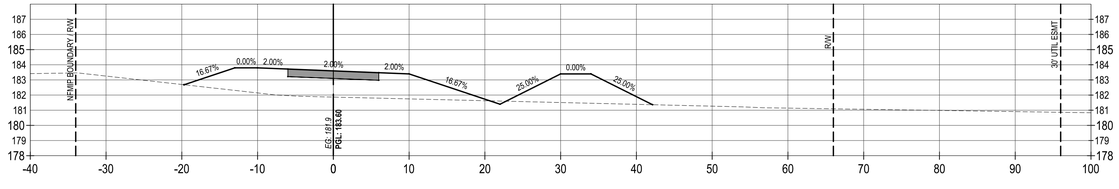
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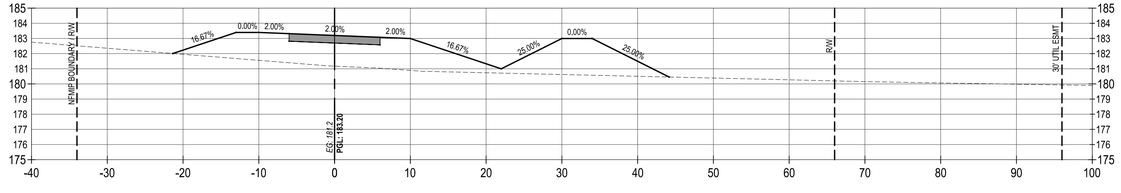
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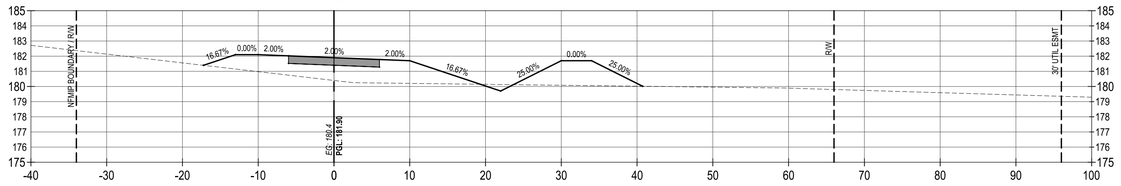
Amir Darabi,
State of Florida, Professional Engineer,
License No. 68298

805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

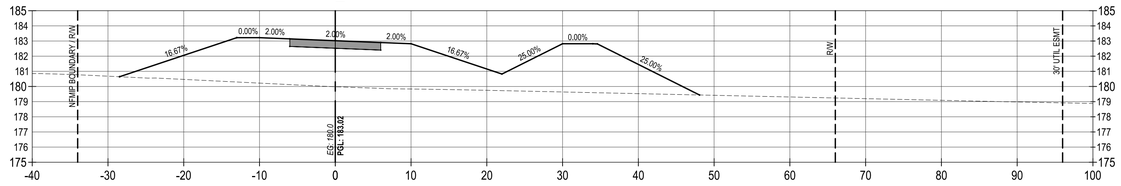
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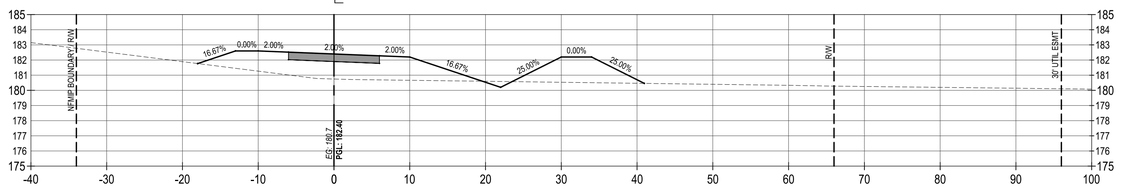
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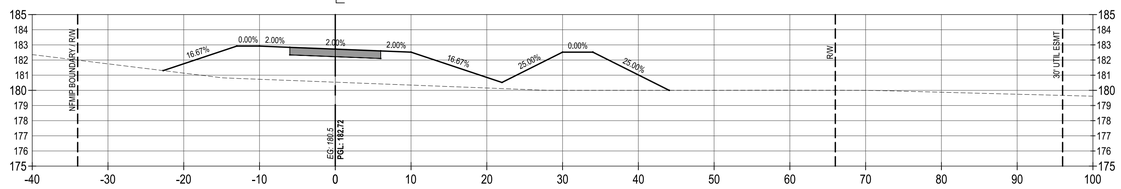
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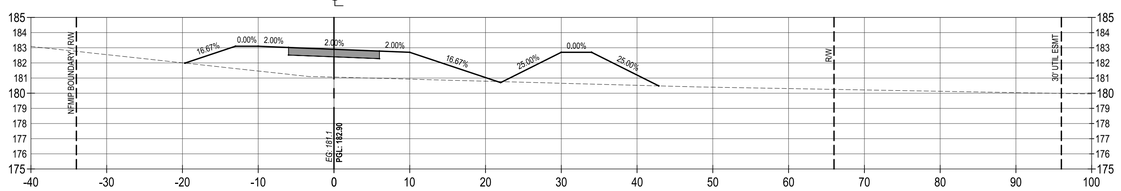
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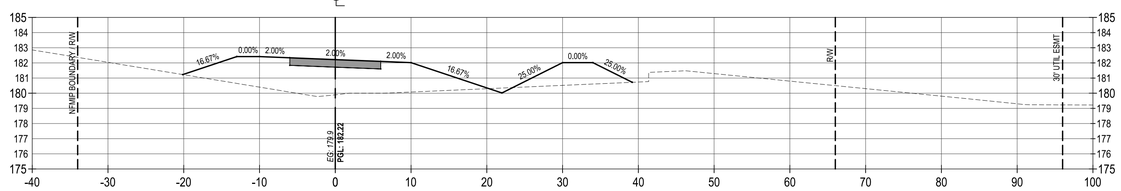
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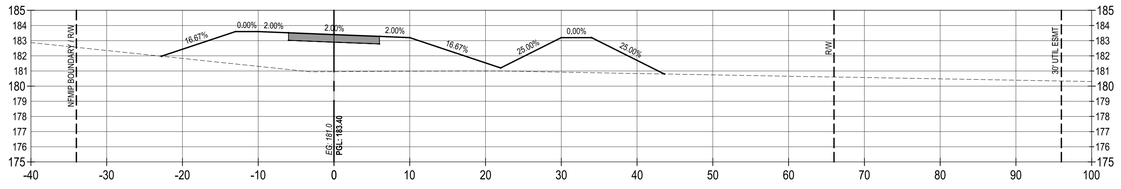
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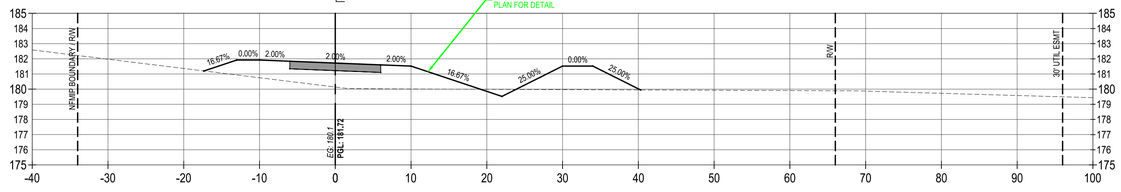
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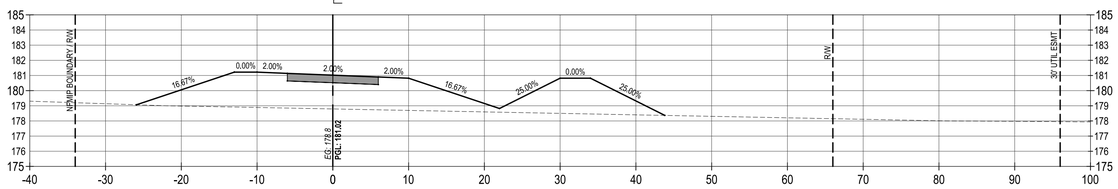
Amir Darabi,
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License No. 68298

805 N. GADSDEN STREET
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CERTIFICATE OF AUTHORIZATION NO. 00006108

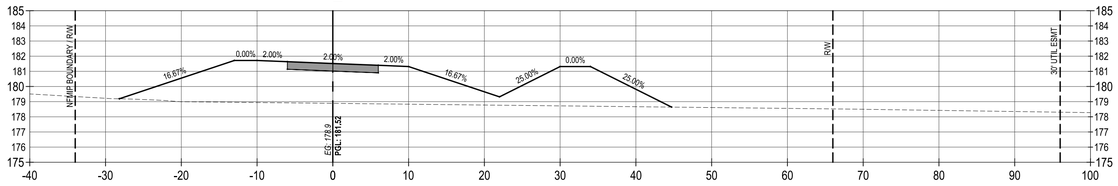
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INDEX NO:	DWG NO: C25

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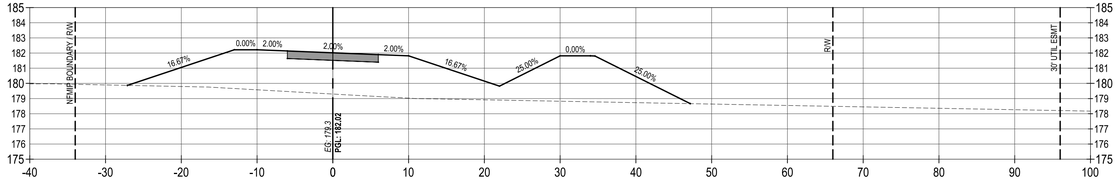
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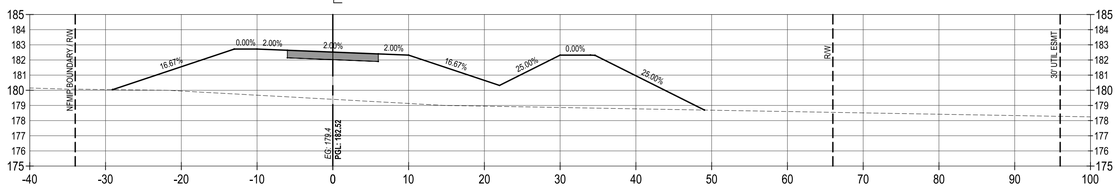
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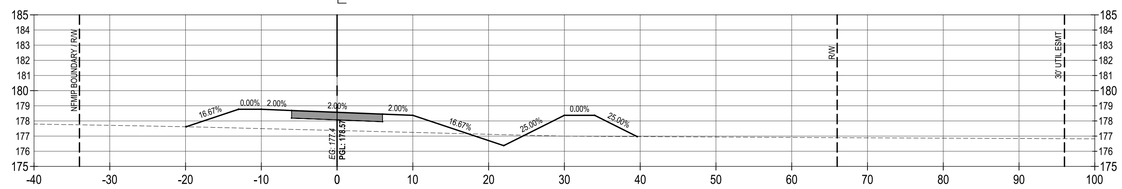
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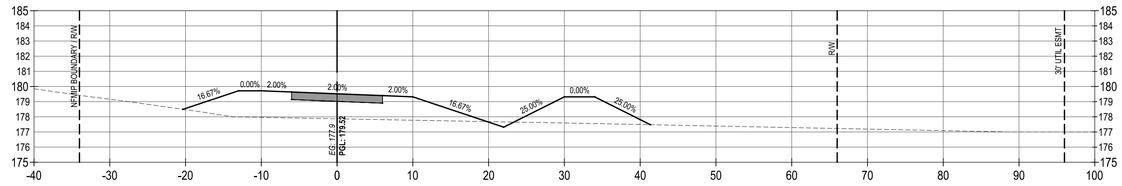
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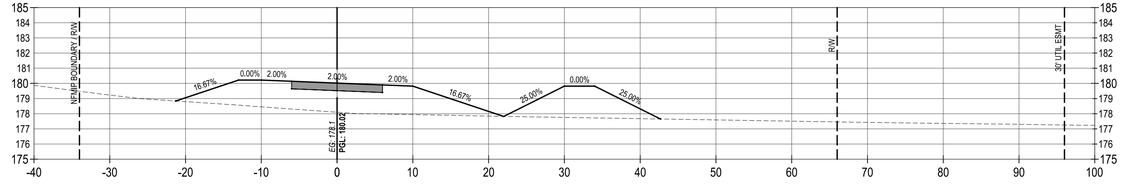
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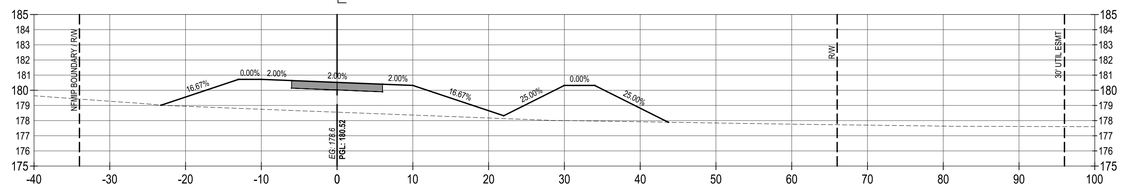
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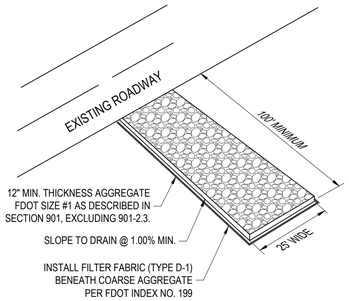
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Amir Darabi,
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License No. 68298

805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
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INDEX NO:	DWG NO:
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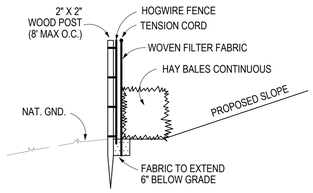


- THE ROAD CONSTRUCTION ACCESS SHALL BE STABILIZED USING 12" MINIMUM THICKNESS OF COARSE AGGREGATE TO REDUCE EROSION CAUSED BY CONSTRUCTION TRAFFIC, AND TO MINIMIZE TRANSPORT OF SEDIMENT ONTO THE EXISTING PAVED ROADWAY.
- AGGREGATE SHALL BE APPLIED IMMEDIATELY AFTER GRADING CONSTRUCTION ENTRANCE AREA.
- IN THE EVENT THAT #1 SIZE AGGREGATE IS NOT AVAILABLE, THE NEXT SMALLER AVAILABLE SIZE AGGREGATE MAY BE SUBSTITUTED WITH THE APPROVAL OF THE ENGINEER.
- THE CONSTRUCTION ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD AND SEDIMENTS ONTO THE PUBLIC STREETS OR GUTTERS. PERIODIC TOP-DRESSING WITH STONE WILL BE NECESSARY AND AN ADEQUATE SUPPLY SHOULD BE HANDY. ANY SEDIMENTS OR MUD SPILLED, DROPPED, WASHED, OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS SHALL BE RECOVERED AND CLEANED UP IMMEDIATELY.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE

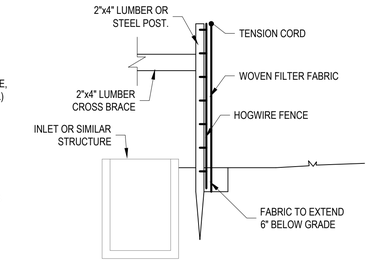
- DIG A 6" X 6" TRENCH AT DESIRED FENCE LOCATION.
- UNROLL SILT FENCE ALONG TRENCH. (SILT-LOK, ENVIROFENCE, OR ENGINEER- APPROVED EQUAL)
- DRIVE STAKE INTO THE DOWNHILL SIDE OF TRENCH W/FILTER FABRIC FACING UPHILL SIDE.
- STAPLE HOGWIRE TO POSTS, EXTENDING FROM TOP OF POSTS TO BOTTOM OF TRENCH.
- LAY THE BOTTOM 6" OF FABRIC INTO THE TRENCH AND FILL W/SOIL FOR PROPER TOE-IN.
- DRAW TENSION CORD AT TOP OF FENCE.



STANDARD SILT FENCE SEDIMENTATION & EROSION CONTROL

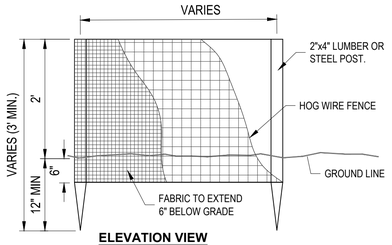
NOT TO SCALE

- DIG A 6" X 6" TRENCH AT DESIRED FENCE LOCATION.
- UNROLL SILT FENCE ALONG TRENCH. (SILT-LOK, ENVIROFENCE, OR ENGINEER- APPROVED EQUAL)
- DRIVE STAKE INTO THE DOWNHILL SIDE OF TRENCH W/FILTER FABRIC FACING UPHILL SIDE.
- STAPLE HOGWIRE TO POSTS, EXTENDING FROM TOP OF POSTS TO BOTTOM OF TRENCH.
- LAY THE BOTTOM 6" OF FABRIC INTO THE TRENCH AND FILL W/SOIL FOR PROPER TOE-IN.
- DRAW TENSION CORD AT TOP OF FENCE.

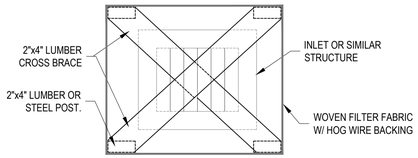


SECTION

NOTE:
STAKES OF OTHER MATERIAL OR SHAPE PROVIDING EQUIVALENT STRENGTH MAY BE USED IF APPROVED BY THE ENGINEER. STAKES OTHER THAN WOOD SHALL BE REMOVED UPON COMPLETION OF THE PROJECT. SEE FDOT INDEX NO. 102 FOR ADDITIONAL INFORMATION.



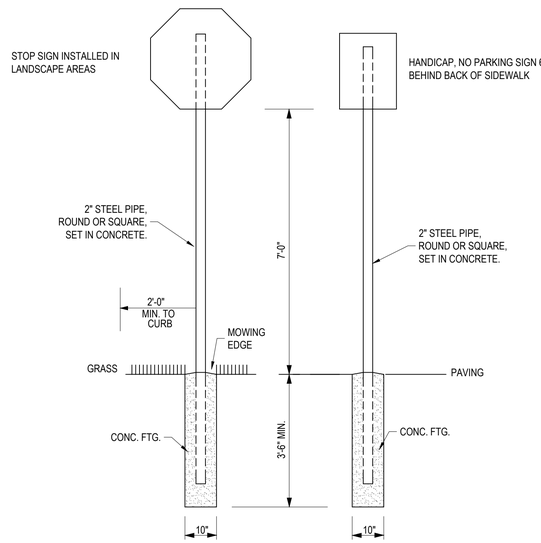
ELEVATION VIEW



PLAN

INLET PROTECTION - A

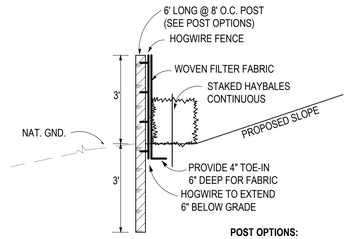
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TRAFFIC SIGNAGE DETAIL

NOT TO SCALE

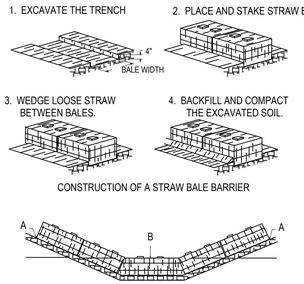
- HEAVY DUTY SILT FENCE INSTALLATION SHALL MEET OR EXCEED ALL REQUIREMENTS OF FDOT TYPE IV SILT FENCE.
- DIG A 6" X 6" TRENCH AT DESIRED BARRIER LOCATION. NO TRENCHING IN CPZ OF TREES TO REMAIN.
- INSTALL POSTS 8' O.C. ON DOWNHILL SIDE OF TRENCH.
- STAPLE HOGWIRE TO POSTS, EXTENDING FROM TOP OF POSTS TO BOTTOM OF TRENCH.
- FOLD TOP 2" OF FABRIC OVER TOP OF FENCE AND STAPLE IN PLACE. LAY FABRIC INTO BOTTOM OF TRENCH AND BACK FILL.
- STAKE HAYBALES CONTINUOUS ALONG UPHILL SIDE OF BARRIER.
- FILTER FABRIC SHALL BE IN CONFORMANCE WITH SECTION 985 FDOT SPEC.



POST OPTIONS:
SOFTWOOD 4" DIA. OR 4"x4"
HARDWOOD 3" DIA.
STEEL 1.33 LBS/FT MIN.

HEAVY DUTY SILT FENCE SEDIMENTATION & EROSION CONTROL

NOT TO SCALE

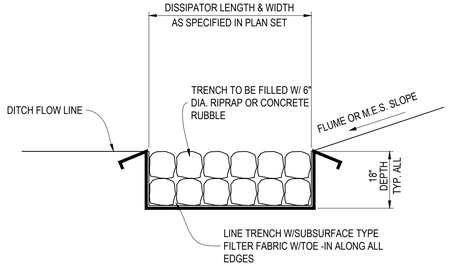


CONSTRUCTION OF A STRAW BALE BARRIER

POINTS A SHOULD BE HIGHER THAN POINT B

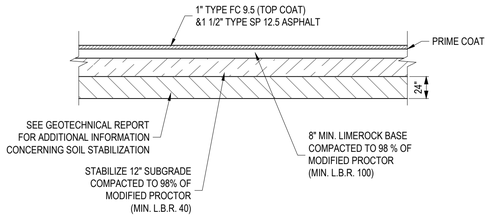
PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

NOT TO SCALE



TYPICAL ENERGY DISSIPATOR SECTION

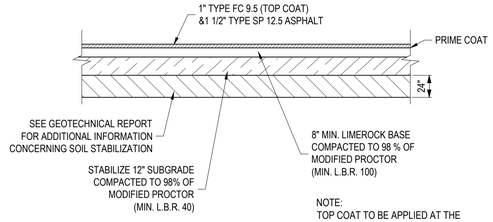
NOT TO SCALE



NOTE:
1) TOP COAT TO BE APPLIED AT THE COMPLETION OF CONSTRUCTION.
2) SEE GEOTECHNICAL REPORT (COLUMBIA COUNTY NORTH FLORIDA MEGA INDUSTRIAL PARK - PLANT, DATED 4/30/2021) FOR STABILIZED SUBGRADE.
3) THE BOTTOM OF THE BASE COURSE SHALL HAVE A MINIMUM SEPARATION OF 12" ABOVE THE SEASON HIGH GROUND WATER TABLE OR UTILIZED UNDERDRAINS (SEE GEOTECH REPORT)

ON-SITE ASPHALT PAVEMENT SECTION

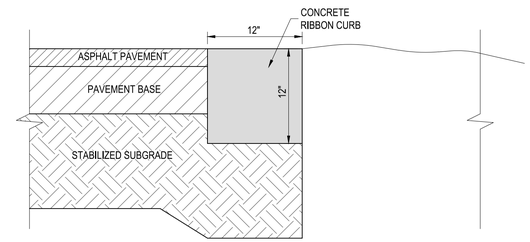
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NOTE:
TOP COAT TO BE APPLIED AT THE COMPLETION OF CONSTRUCTION.

ASPHALT PAVEMENT SECTION (FDOT RIGHT-OF-WAY)

NOT TO SCALE



12" RIBBON CURB DETAIL

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MooreBass CONSULTING TALLAHASSEE ATLANTA www.moorebass.com

CONSTRUCTION DETAIL SHEET

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Amir Darabi,
State of Florida, Professional Engineer,
License No. 68298
805 N. GADSDEN STREET
TALLAHASSEE, FL 32303
CERTIFICATE OF AUTHORIZATION NO. 00006108

PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO: C27

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PROPERTY LINE (TYP)

WETLANDS

STORMWATER POND

GRAPHIC SCALE
0 20 40 80
SCALE IN FEET

PROPERTY LINE

SLUDGE PUMP STATION M10

M7 BNR PACKAGE WWTP

LEACHATE STORAGE TANKS M6

1.5 MG EFFLUENT STORAGE POND
A
M18

CLARIFIER

OXIDATION DITCH

M14 PLANT DRAIN PUMP STATION

1.5 MG RCW STORAGE TANK

CHLORINE CONTACT TANKS M11

CLARIFIER

OXIDATION DITCH

GENERATOR & FUEL TANK

ELECTRICAL BUILDING

TRANSFORMER

HEADWORKS

RCW TRANSFER PS

FILTERS

RAS/WAS

OXIDATION DITCH

INFLUENT PUMP STATION M4

SMW-1

MONITORING WELL (FUTURE)

PLANT WATER PS

FLOW METER

1.5 MG RCW STORAGE TANK

CLARIFIER

INFLUENT MASTER MANHOLE

HIGH SERVICE PS

CHEMICAL STORAGE AND FEED SYSTEMS M16

ANALYZER STRUCTURE

OPERATIONS BUILDING A1

ENTRANCE GATE

EXPLORATORY WELL (FUTURE)
EX-1

FUTURE ELECTRICAL BUILDING

FUTURE TRANSFORMER

FUTURE GENERATOR AND FUEL TANK

30'

UTILITY EASEMENT

PROPERTY LINE

60' R/W

ACCESS ROAD

THOMAS W. FRIEDRICH LICENSE No. 61281 STATE OF FLORIDA PROFESSIONAL ENGINEER

LEGEND:
PROPOSED WORK
FUTURE PHASE 2
FUTURE PHASE 3
DWG. NO: M1

BID SUBMITTAL

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
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MECHANICAL SITE PLAN

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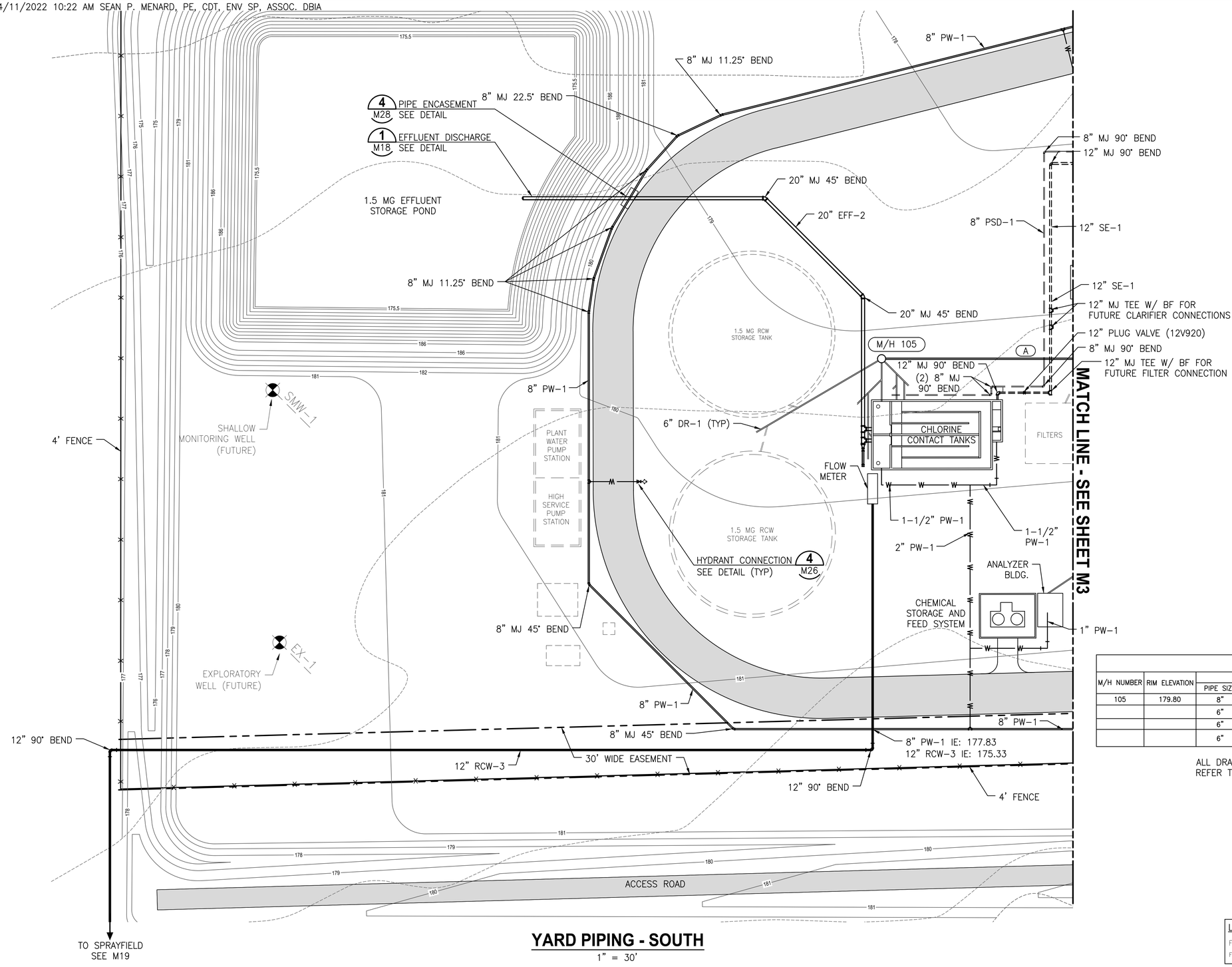
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YARD PIPING - SOUTH

1" = 30'

GRAPHIC SCALE

0 15 30 60

SCALE IN FEET

DRAINAGE NETWORK TABLE						
M/H NUMBER	RIM ELEVATION	CONNECTOR			PIPE DESIGNATION	PIPE DETAILS
		PIPE SIZE	DIRECTION	INVERT ELEVATION		
105	179.80	8"	NORTH	164.40	A	±122 LF @ 0.4%
		6"	NORTHEAST	175.40		
		6"	EAST	164.44		
		6"	SOUTHEAST	173.73		STUB OUT FOR FUTURE CONNECTION

ALL DRAINAGE PIPE IS PVC UNLESS NOTED OTHERWISE.
REFER TO PIPE SCHEDULE ON SHEET G5 FOR DETAILS.

LEGEND:
FUTURE PHASE 2 ——
FUTURE PHASE 3 — — — —

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

YARD PIPING

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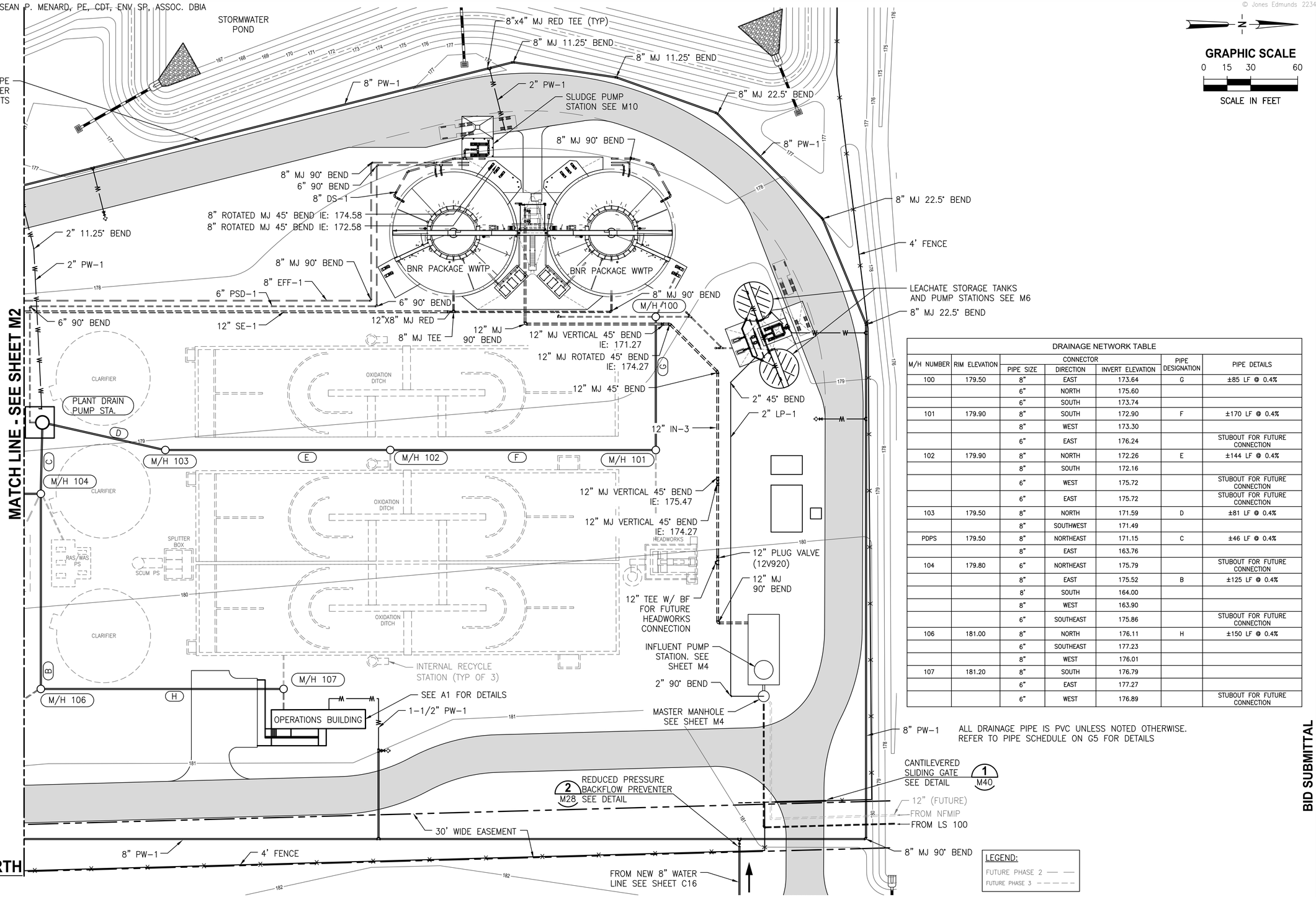
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YARD PIPING - NORTH

1" = 30'

DRAINAGE NETWORK TABLE

M/H NUMBER	RIM ELEVATION	CONNECTOR PIPE SIZE	CONNECTOR DIRECTION	CONNECTOR INVERT ELEVATION	PIPE DESIGNATION	PIPE DETAILS
100	179.50	8"	EAST	173.64	G	±85 LF @ 0.4%
		6"	NORTH	175.60		
		6"	SOUTH	173.74		
101	179.90	8"	SOUTH	172.90	F	±170 LF @ 0.4%
		8"	WEST	173.30		
		6"	EAST	176.24		STUBOUT FOR FUTURE CONNECTION
102	179.90	8"	NORTH	172.26	E	±144 LF @ 0.4%
		8"	SOUTH	172.16		
		6"	WEST	175.72		STUBOUT FOR FUTURE CONNECTION
		6"	EAST	175.72		STUBOUT FOR FUTURE CONNECTION
103	179.50	8"	NORTH	171.59	D	±81 LF @ 0.4%
		8"	SOUTHWEST	171.49		
PDPS	179.50	8"	NORTHEAST	171.15	C	±46 LF @ 0.4%
		8"	EAST	163.76		
104	179.80	6"	NORTHEAST	175.79		STUBOUT FOR FUTURE CONNECTION
		8"	EAST	175.52	B	±125 LF @ 0.4%
		8'	SOUTH	164.00		
		8"	WEST	163.90		
		6"	SOUTHEAST	175.86		STUBOUT FOR FUTURE CONNECTION
106	181.00	8"	NORTH	176.11	H	±150 LF @ 0.4%
		6"	SOUTHEAST	177.23		
		8"	WEST	176.01		
107	181.20	8"	SOUTH	176.79		
		6"	EAST	177.27		
		6"	WEST	176.89		STUBOUT FOR FUTURE CONNECTION

8" PW-1 ALL DRAINAGE PIPE IS PVC UNLESS NOTED OTHERWISE. REFER TO PIPE SCHEDULE ON G5 FOR DETAILS

LEGEND:
FUTURE PHASE 2 ——
FUTURE PHASE 3 - - - - -

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NORTH FLORIDA MEGA INDUSTRIAL PARK
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COLUMBIA COUNTY, FLORIDA

YARD PIPING

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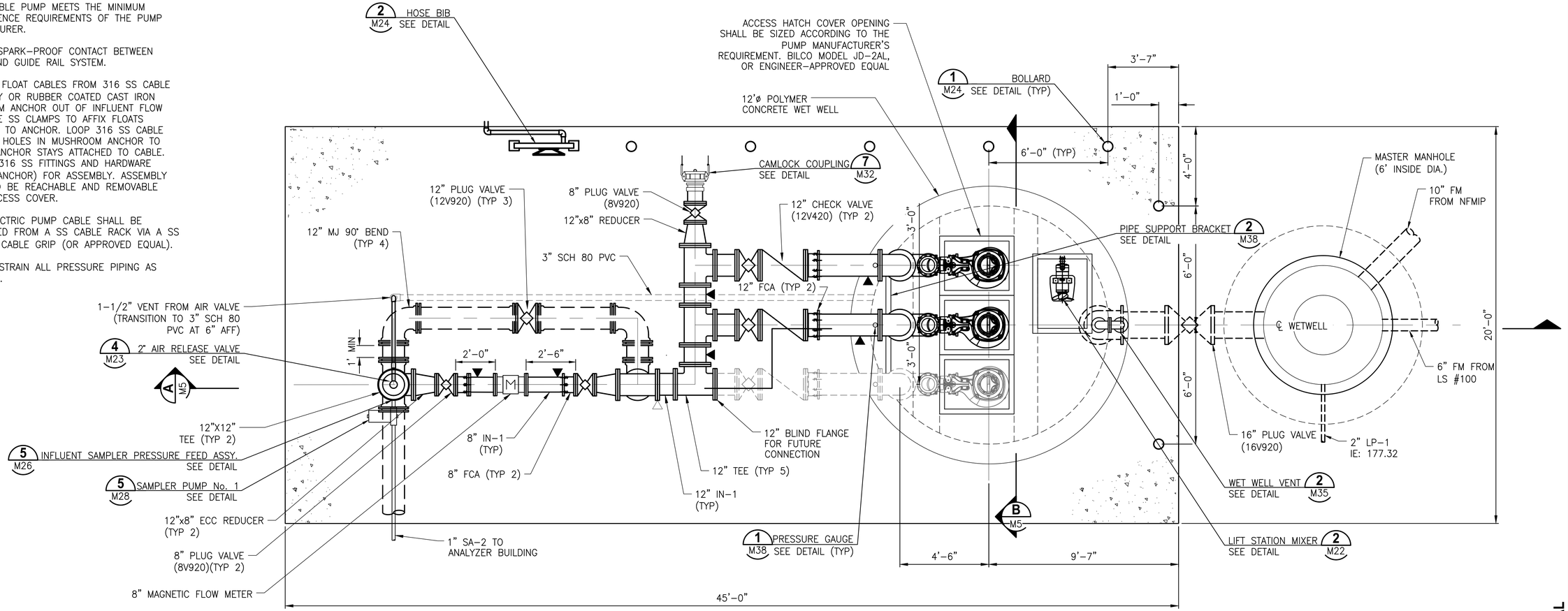
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PUMP STATION NOTES

1. PUMP PLACEMENT SHALL BE PER MANUFACTURER'S RECOMMENDATIONS.
2. CONTRACTOR SHALL VERIFY PUMP MANUFACTURER'S REQUIREMENTS FOR OPENING IN CONCRETE FOR CAST–IN PLACE ACCESS HATCH COVER FRAME.
3. ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE SHALL BE PAINTED WITH BITUMINOUS COATING PER SPECIFICATIONS.
4. LOW ALARM ON/REDUNDANT ALL PUMPS OFF LEVEL SHALL BE SET SO THAT THE SUBMERSIBLE PUMP MEETS THE MINIMUM SUBMERGENCE REQUIREMENTS OF THE PUMP MANUFACTURER.
5. PROVIDE SPARK–PROOF CONTACT BETWEEN PUMPS AND GUIDE RAIL SYSTEM.
6. SUSPEND FLOAT CABLES FROM 316 SS CABLE W/ EPOXY OR RUBBER COATED CAST IRON MUSHROOM ANCHOR OUT OF INFLUENT FLOW PATH. USE SS CLAMPS TO AFFIX FLOATS SECURELY TO ANCHOR. LOOP 316 SS CABLE THROUGH HOLES IN MUSHROOM ANCHOR TO ENSURE ANCHOR STAYS ATTACHED TO CABLE. USE ALL 316 SS FITTINGS AND HARDWARE (EXCEPT ANCHOR) FOR ASSEMBLY. ASSEMBLY NEEDS TO BE REACHABLE AND REMOVABLE FROM ACCESS COVER.
7. EACH ELECTRIC PUMP CABLE SHALL BE SUPPORTED FROM A SS CABLE RACK VIA A SS KELLUMS CABLE GRIP (OR APPROVED EQUAL).
8. FULLY RESTRAIN ALL PRESSURE PIPING AS SPECIFIED.



PIPE SUPPORT LEGEND

- ▲ U-BOLT TYPE — 1 M23
- △ FLANGE TYPE — 2 M23

INFLUENT PUMP STATION PLAN

3/8" = 1'–0"

GRAPHIC SCALE
0 1 2 4
SCALE IN FEET

BID SUBMITTAL

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DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

INFLUENT PUMP STATION PLAN

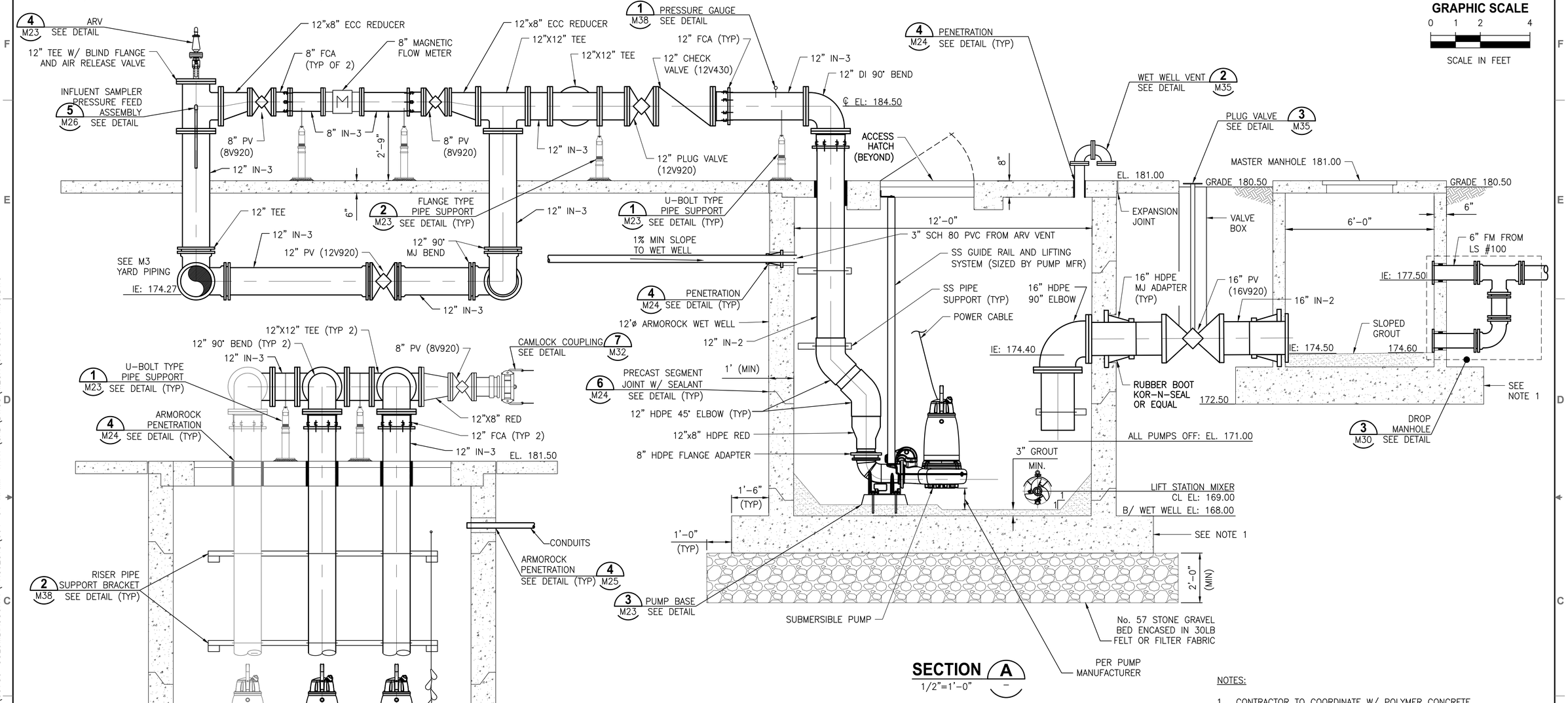
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SECTION A
1/2"=1'-0"

SECTION B
1/2"=1'-0"

GRAPHIC SCALE
0 1 2 4
SCALE IN FEET

FLOAT LEVEL CONTROL TABLE	
EL	**FUNCTION**
174.50	HWL ALARM ON – ALARM
174.00	LAG PUMP ON
173.50	LEAD PUMP ON
171.00	ALL PUMPS OFF
169.50	EMERGENCY OFF – ALARM

NOTES:

1. CONTRACTOR TO COORDINATE W/ POLYMER CONCRETE MANUFACTURER FOR BASE CIRCUMFERENCE WIDTH AND THICKNESS REQUIREMENTS FOR BUOYANCY. CONTRACTOR SHALL PROVIDE AND SUBMIT BUOYANCY CALCULATIONS THAT HAVE BEEN SIGNED AND SEALED BY A FLORIDA REGISTERED PROFESSIONAL ENGINEER W/ CONSTRUCTION SUBMITTAL PACKAGE
2. FORCE MAIN RISER PIPE AND FITTINGS SHALL BE DIPS HDPE DR11. ALL JOINTS IN HDPE PIPE SHALL BE FUSED. HPDE FLANGE ADAPTERS SHALL HAVE 316 SS BACKING RING. ALL HARDWARE SHALL BE 316 SS.

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

INFLUENT PUMP STATION SECTION

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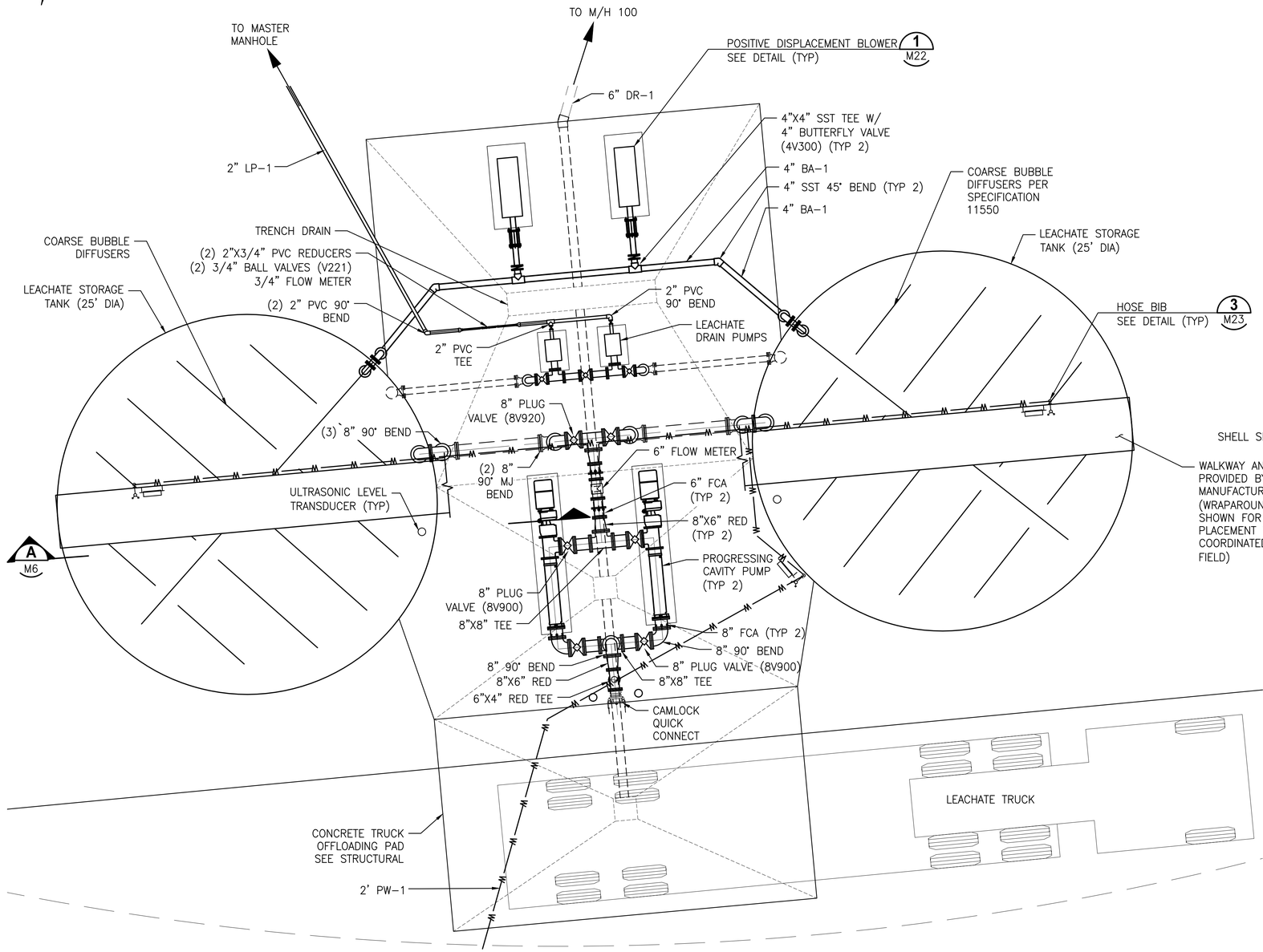
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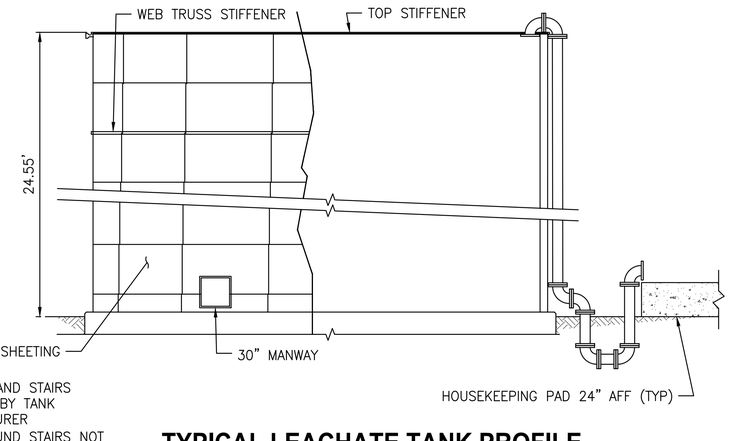
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GRAPHIC SCALE
0 2 4 8
SCALE IN FEET



LEACHATE TANKS PLAN
1" = 4'



TYPICAL LEACHATE TANK PROFILE
1" = 4'

FLOAT LEVEL CONTROL TABLE	
ELEV.	**FUNCTION**
203.50	TOP OF STRUCTURE
198.50	HIGH LEVEL FLOAT
181.00	LOW LEVEL FLOAT
179.50	FINISHED FLOOR ELEVATION (FFE)

NOTES:

1. LEACHATE STORAGE TANKS SHALL HAVE A CAPACITY OF 80,000 GALLONS EACH.
2. HOUSEKEEPING PADS SHALL EXTEND 24" AFF (TYP).

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

LEACHATE TANKS PLAN

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GRAPHIC SCALE
0 2 4 8 16
SCALE IN FEET

NOTES:
1. LOCATIONS FOR POTABLE WATER CONNECTIONS.

1 M29 WASHDOWN PAD SEE DETAIL (TYP)
2" PW-1
6" CO (TYP)
SLUDGE PUMP STATION SEE M10
8" MJ 11.25° BEND
8" EFF-1
6" PSD-1
C M9
EQ PUMPS
CONCRETE EQUIPMENT PAD. REFER TO STRUCTURAL DWGS.
BOLLARD SEE DETAIL (TYP) 1 M24
FLOOR DRAIN SEE DETAIL (TYP) 2 M29
2 CY DUMPSTER
8" MJ 45° BEND
8" DS-1
8" PLUG VALVE (8V920)
8" MJ 90° BEND
8" DS-1
4" EQ-1
D M9
FLOW METER
EQUALIZATION 211,000 GAL
6" 45° BEND
6" 22.5° BEND
3 M25 CARBON FEED PUMP SKID SEE DETAIL
WALKWAY (TYP)
HOSE BIB 1 SEE DETAIL (TYP) 2 M24
TANK FLG PIPE CONNECTION BY TANK MANUFACTURER (TYP)
DIGESTER 80,944 GAL
CLARIFIER 33'-6" DIA.
CONTROL PANEL (TYP)
3/4" CF-1
2 M22 MIXER SEE DETAIL (TYP)
CARBON FEED INJECTION POINT (TYP)
RE-AERATION 5,059 GAL
PRE-ANOXIC BLENDING ZONE
RAS (AIR LIFT)
POST ANOXIC 35,413 GAL
PRE-ANOXIC 1 37,099 GAL
6" 90° BEND
6" EQ-1
6" 11.25° BEND (TYP)
MANUAL SCREEN PER MANUFACTURER
INFLUENT SCREEN AND CONVEYOR SEE DETAIL (TYP) 1 M9
FLANGED CONNECTION (TO BE COORDINATED W/ TANK MFR -TYP)
8" LPA-1 (TYP)
A M9
B M9
PRE-ANOXIC 2 37,099 GAL
D.O. PROBE (TYP)
AERATION 187,182 GAL
6" 45° BEND
6" 22.5° BEND
IR PUMPS
FLOW METER
EQ 25HP
SWING 75HP
AER 75HP
8" LPA-1 (TYP) OVER TOP OF WALL. COORDINATE PIPE CONNECTION AND SUPPORT WITH TANK MANUFACTURER
8" BUTTERFLY VALVE (8V360) (TYP OF 8)
6" IR-1
6" 11.25° BEND (TYP)
FLANGED CONNECTION (TO BE COORDINATED W/ TANK MFR -TYP)
6" 45° BEND
12" IN-3
1 M42 PIPE SUPPORT SEE DETAIL (TYP)
1 M22 PIPE SUPPORT SEE DETAIL (TYP)
8" SE-1
8" MJ 90° BEND
M/H 100
PSD-1
8"X8" MJ TEE
8"X12" MJ RED
12" SE-1
CLEAN OUT SEE DETAIL (TYP) 3 M26
POSITIVE DISPLACEMENT BLOWER SEE DETAIL (TYP) 3 M22
6" WYE
6" DR-1

NOTE:
PIPES AND FITTINGS FOR EQ-1 AND IR-1 ARE SIMILAR FOR BOTH TANKS

BNR PACKAGE PLANT TANKS PLAN
1" = 8'

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

BNR PACKAGE PLANT TANKS

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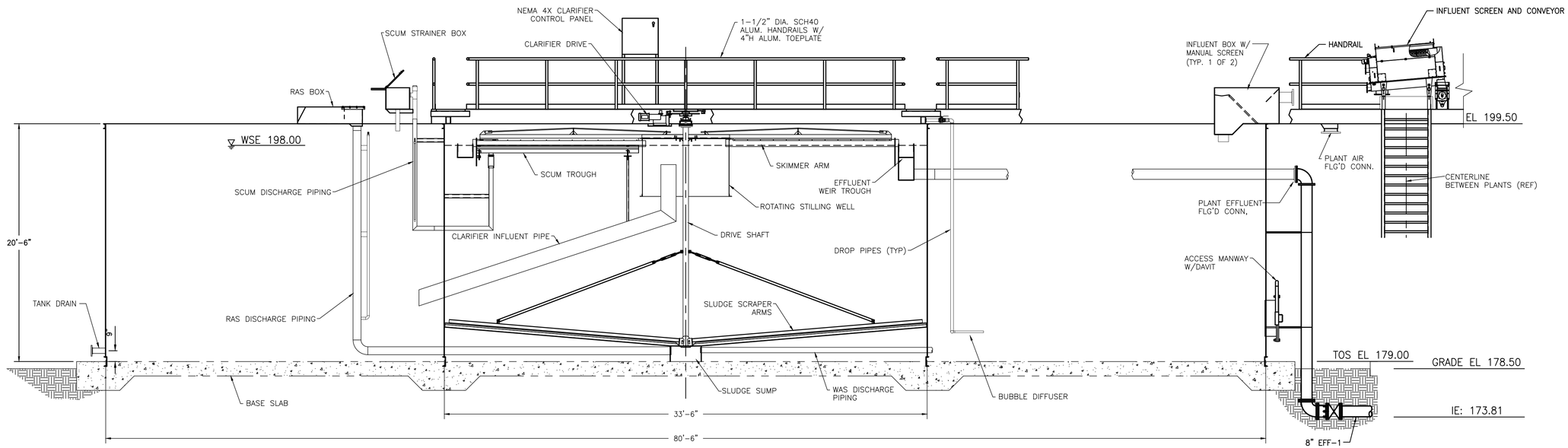
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GRAPHIC SCALE

0 1 2 4 8

SCALE IN FEET
1/4"=1'-0"



BNR PACKAGE PLANTS SECTION

1" = 4'-0"

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

BNR PACKAGE PLANTS SECTION

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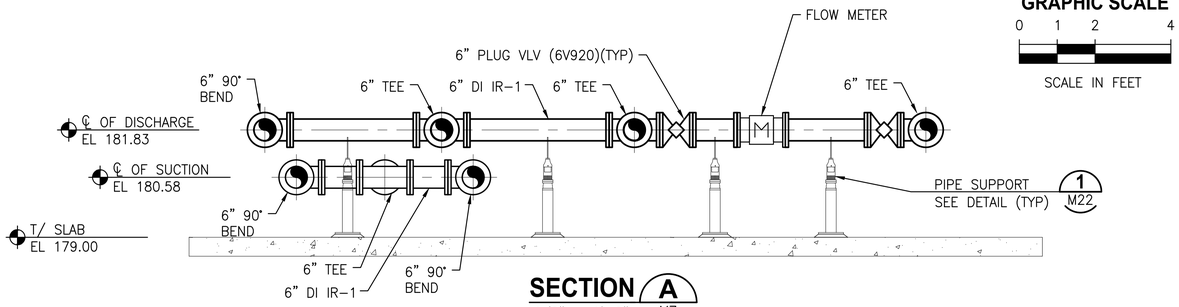
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DWG NO: M8

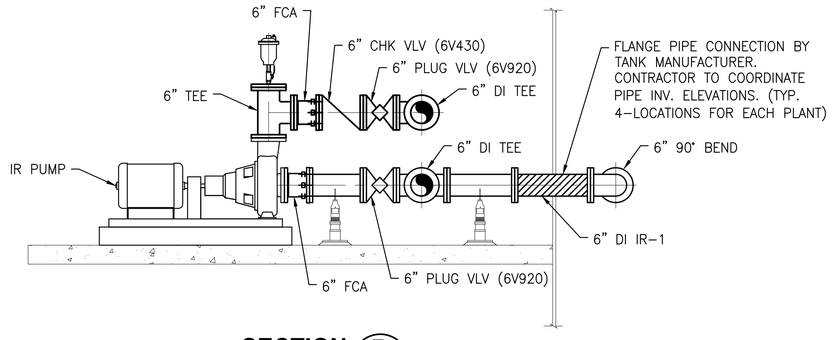
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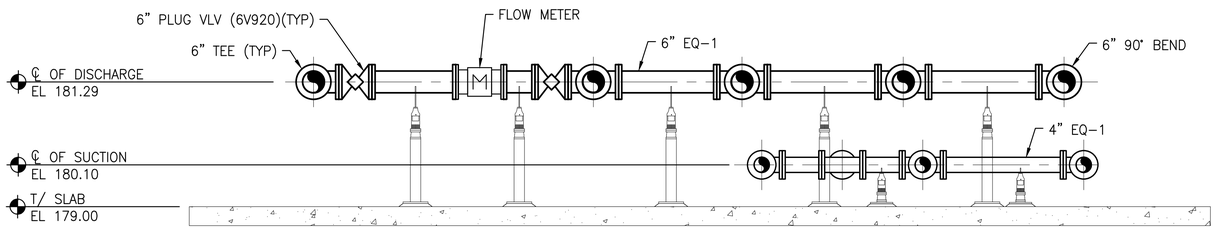
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0 1 2 4
SCALE IN FEET



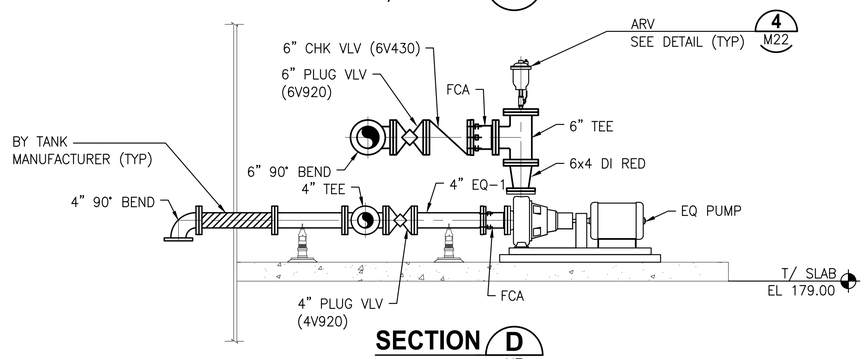
SECTION A
1/2" = 1'-0" M7



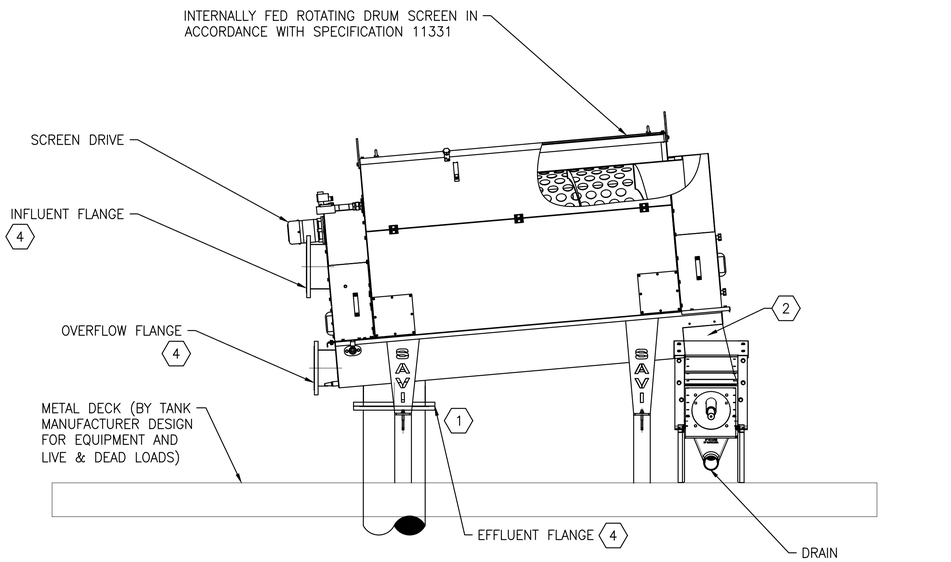
SECTION B
1/2" = 1'-0" M7



SECTION C
1/2" = 1'-0" M7



SECTION D
1/2" = 1'-0" M7



INFLUENT SCREEN AND CONVEYOR DETAIL 1
NTS

NOTES:

1. CONTRACTOR AND MANUFACTURER COORDINATE FINAL HEIGHT OF UNITS TO ALLOW PROPER DISCHARGE TO CONVEYOR.
2. CONTRACTOR AND MANUFACTURER TO COORDINATE CONNECTION LENGTH OF DISCHARGE CHUTES FOR EACH DRUM SCREEN CONNECTION.
3. STAINLESS STEEL DISCHARGE CHUTE TO DUMPSTER (BY CONVEYOR MANUFACTURER)
4. SEE PIPING AND VALVE SCHEMATIC FOR INFLUENT SCREEN AND MANUAL SCREEN. SEE 3 M31

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

IR AND EQ PUMP STATION SECTIONS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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DATE: APRIL 2022
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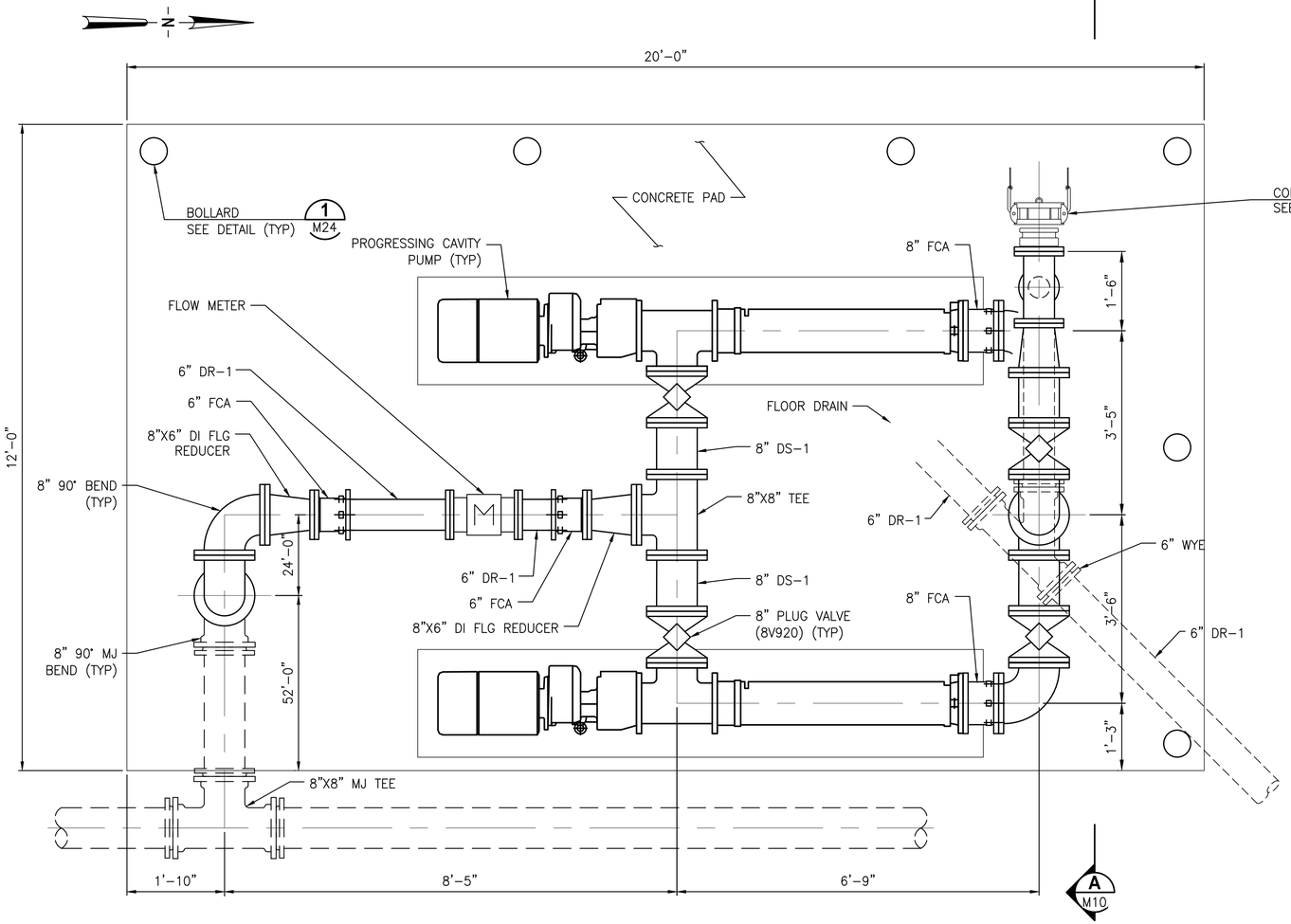
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GRAPHIC SCALE

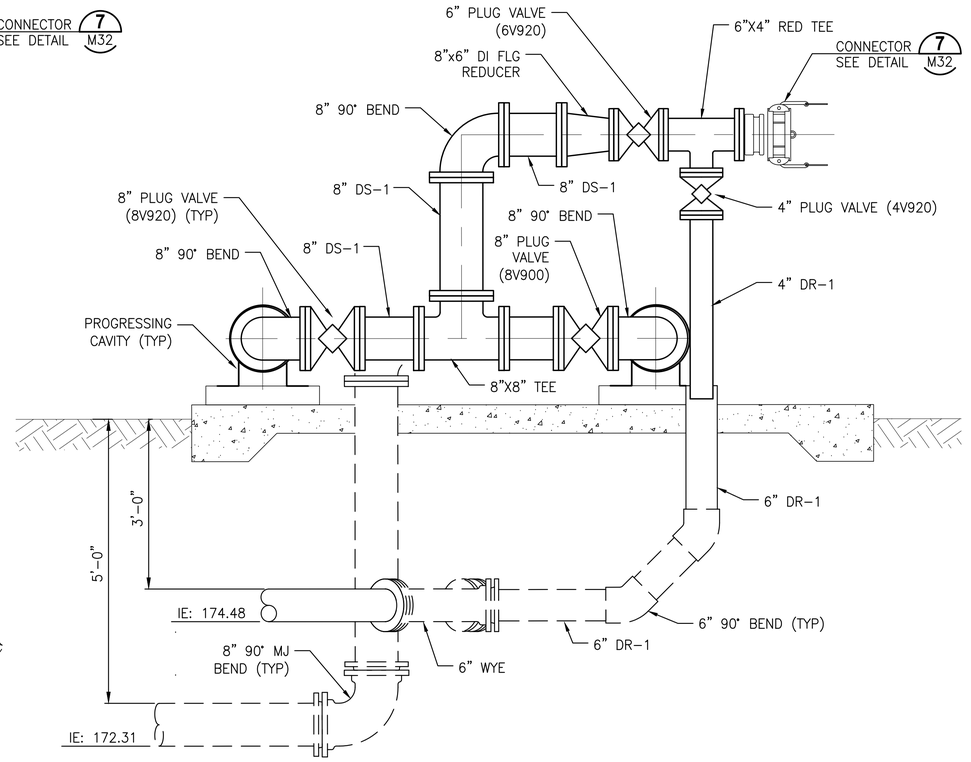
0 0.5 1 2

SCALE IN FEET



SLUDGE PUMP STATION PLAN

3/4" = 1' 0"



SECTION A M10

3/4" = 1' 0"

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

SLUDGE PUMP STATION PLAN AND SECTION

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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8"X6" MJ TEE (TYP)
6"X6" FLG TEE W/ BLIND FLANGE (TYP)
B M12 SEE INSET BELOW
8" TO EQUALIZATION BASIN TANKS
6" 45° BEND
8" 90° BEND
8" EFF-1
6" DR-1
6" DR-1
20" HDPE TO EFFLUENT STORAGE POND
20" PVC TO HDPE ADAPTER. POLYCAM SERIES 730, OR ENGINEER APPROVED EQUAL
TO RECLAIMED WATER STORAGE TANKS (FUTURE) (BF)
8"X6" MJ TEE
6"X6" FLG TEE W/ BLIND FLANGE
20" SLUICE GATE (TYP 2)
20"X20" MJ TEE
6"X8" MJ RED
12" GATE VALVE (12V400)
6" EFF-1
3 M29 RESTRAINED CONNECTION SEE DETAIL(TYP)
20"X20" MJ TEE
6"X6" MJ TEE W/ BLIND FLANGE
6" MJ 90° BEND
20" PVC
20"x10" MJ RED
10" 22.5° MJ BEND
6" DR-1
12"X8" RED TEE (TYP)
12" RCW-1
10" 22.5° DI BEND (CLEAN OUT)
10" TO RECLAIMED WATER STORAGE TANKS (FUTURE)
12" MJ 90° BEND (TYP)
HANDRAIL (TYP)
12"X8" REDUCER
8" GATE VALVE (8V682)(TYP 2)
12" GATE VALVE (12V682)
PAD (MISC.)
8" RCW FLOW METER
12"X8" REDUCER
12"X12" TEE (TYP)
FUTURE HYDRAULIC CONTROL GATE VALVE
4 M23 FLANGE MOUNTED AIR RELEASE VALVE SEE DETAIL
12"X12" TEE W/ BLIND FLANGE
12" MJ 90° BEND
TO SPRAYFIELD
BF
2'-2"
2'-2"
1'-0"
C M12
6" GV (6V600) (TYP 2)
CC-SG-1
CC-SG-2
CC-G-3
12" GATE VALVE (12V600)
6" CV (6V430) (TYP 2)
8" CV (8V400) (TYP 2)
8" FCA (TYP 2)
BF (TYP)
4'-10"
4'-10"
3'-0"
10'-0"
6'-0"
8" GV (8V680) (TYP 6) (2) 12" 90° BENDS
STAIRS W/ STOOP (TYP)
6" CLEANOUT 3 M26 SEE DETAIL(TYP)
RECLAIMED WATER TRANSFER PUMP (TYP)
REJECT WATER PUMP (TYP)
WEIR PLATE 1 M34 SEE DETAIL (TYP)
SAMPLE PUMP No. 3 5 M28 SEE DETAIL
CC-W-1
CC-W-2
SAMPLE PUMP No. 4 5 M28 SEE DETAIL
8"
8"
8"
1'-0"
46'-0"
SLOPE TO DRAIN (TYP)
8"
6'-0" (TYP)
1'-3"
53'-0"
72'-0"
NOTES:
1. FRP PARSHALL FLUME SHALL NOT BE PAINTED.
12" MJ 90° BEND
12" DI 90° BEND
NaOCI INJECTION PORT
STATIC MIXER
GATE VALVE (12V900)
12" FCA
12" SE-1
12" SE-1
BF
12" FROM BNR TANKS SHEET M2
12" MJ TEE
C M13
4 M25 WALL PIPE SEE DETAIL
5'-0"
6'-0"
FUTURE 12" FROM FILTERS
LIT TRANSMITTER LOCATED PER FLUME MANUFACTURER RECOMMENDATION
STILLING WELL
PARSHALL FLUME W/ A 12" THROAT
CC-G-1
4'-0"
1'-0"
1'-0"
5'-0"
SAMPLE PUMP No. 2 5 M28 SEE DETAIL
A M12
42'-2"
1'-0"
6'-0" (TYP)
CC-G-2
A M13
4'-0"
SLIDE GATE SEE SHEET M37
6'-0"
3/4" NaOCI IN 3" CONTAINMENT PVC FROM CHEMICAL STORAGE FEED FACILITY.
1'-0"
8'-0"
3/4" SAMPLE LINE IN 3" CONTAINMENT PVC TO ANALYZER STRUCTURE
GRAPHIC SCALE
0 1 2 4 8
SCALE IN FEET

M/H 105
±22'-0"
8" GV (8V600) (TYP 3)
6" WYE (TYP)
6" CLEAN-OUT (TYP) 3 M26
8" 90° BENDS (TYP)
8" 90° BEND (TYP)
8"X8" TEE (TYP)
(2) 8" 90° BENDS
6" GATE VALVE (TYP) (6V982)
±2'-6"
RESTRAINED CONNECTION 3 M27 SEE DETAIL
FLANGE MOUNTED AIR RELEASE VALVE 4 M23 SEE DETAIL
REJECT FLOW METER
INSET NTS
8" 90° BEND
8"X8" TEE W/ BLIND FLANGE

CHLORINE CONTACT TANKS PLAN
1/4" = 1'-0"

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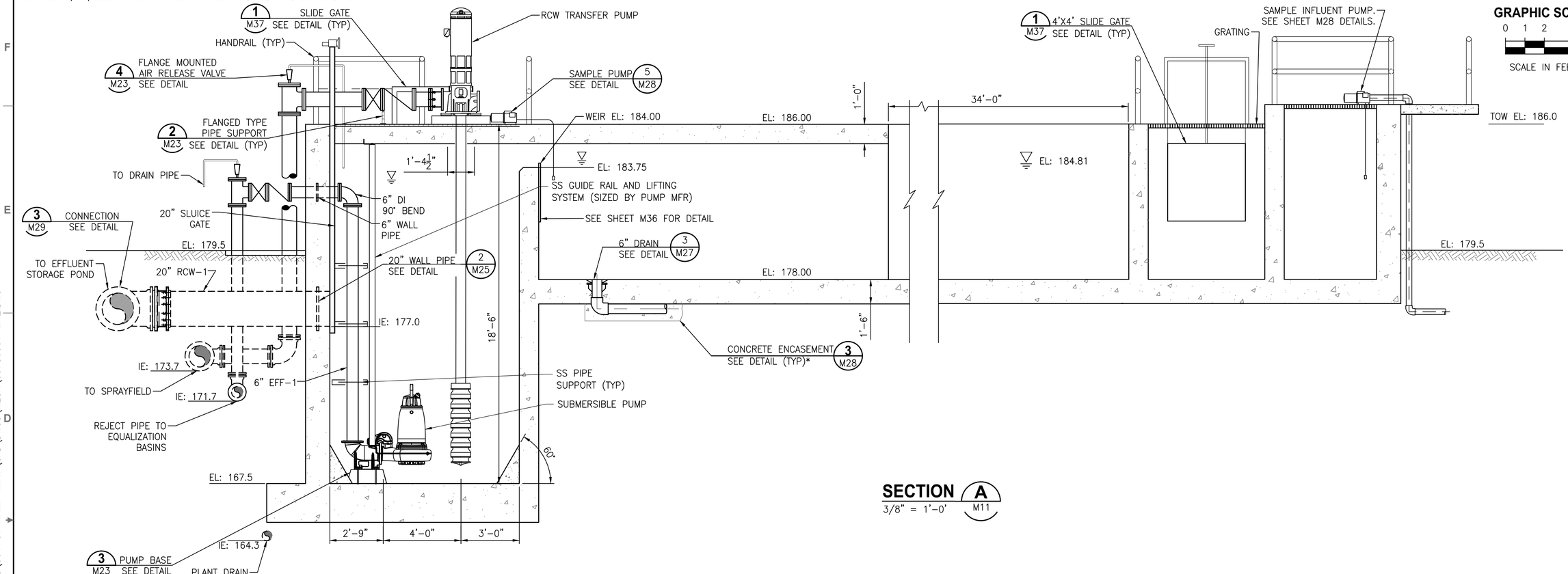
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WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

CHLORINE CONTACT TANKS PLAN AND SECTIONS

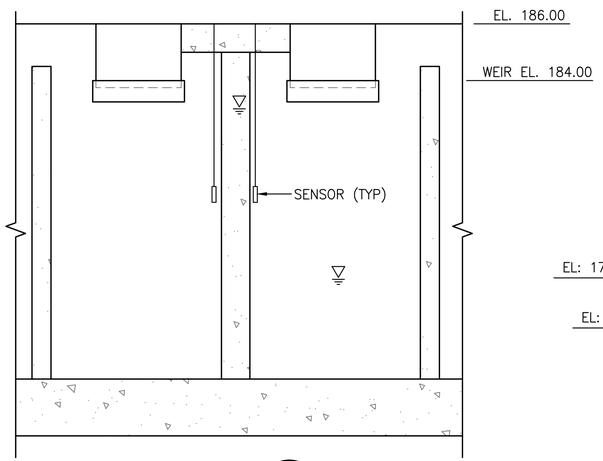
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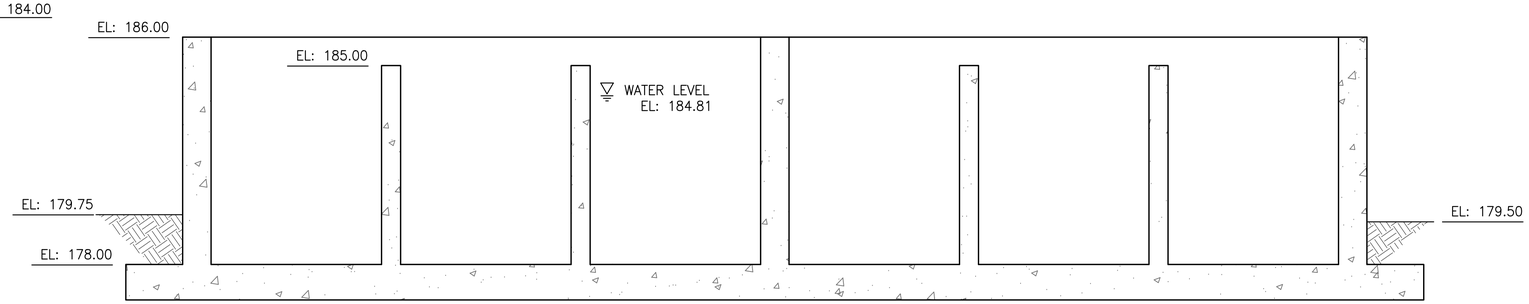
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SECTION A
3/8" = 1'-0" M11



SECTION C
3/8" = 1'-0" M11



SECTION B
3/8" = 1'-0" M11

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COLUMBIA COUNTY, FLORIDA

CHLORINE CONTACT TANKS SECTIONS

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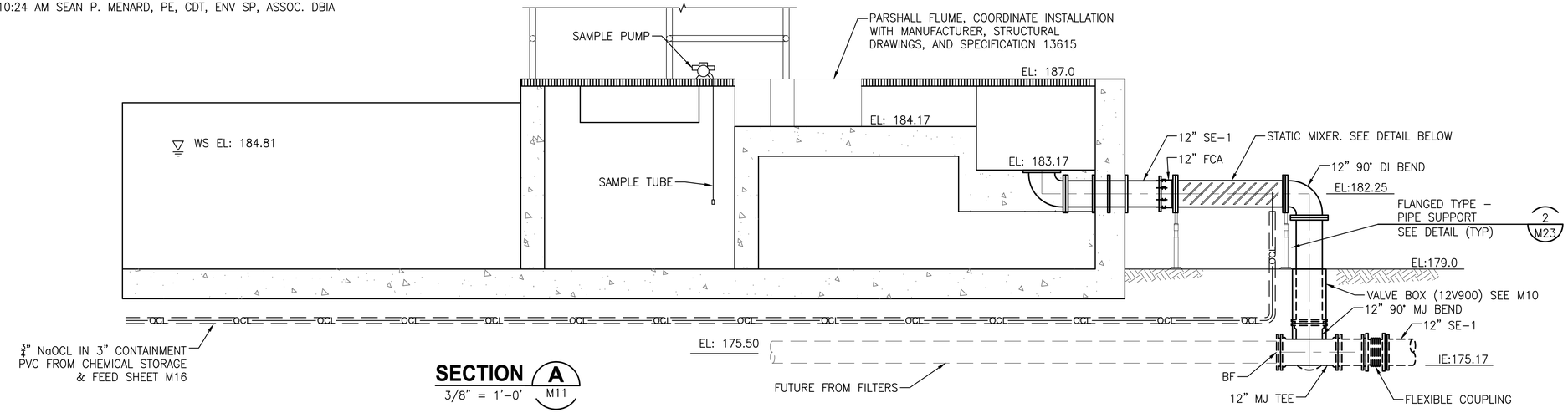
PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO: M12

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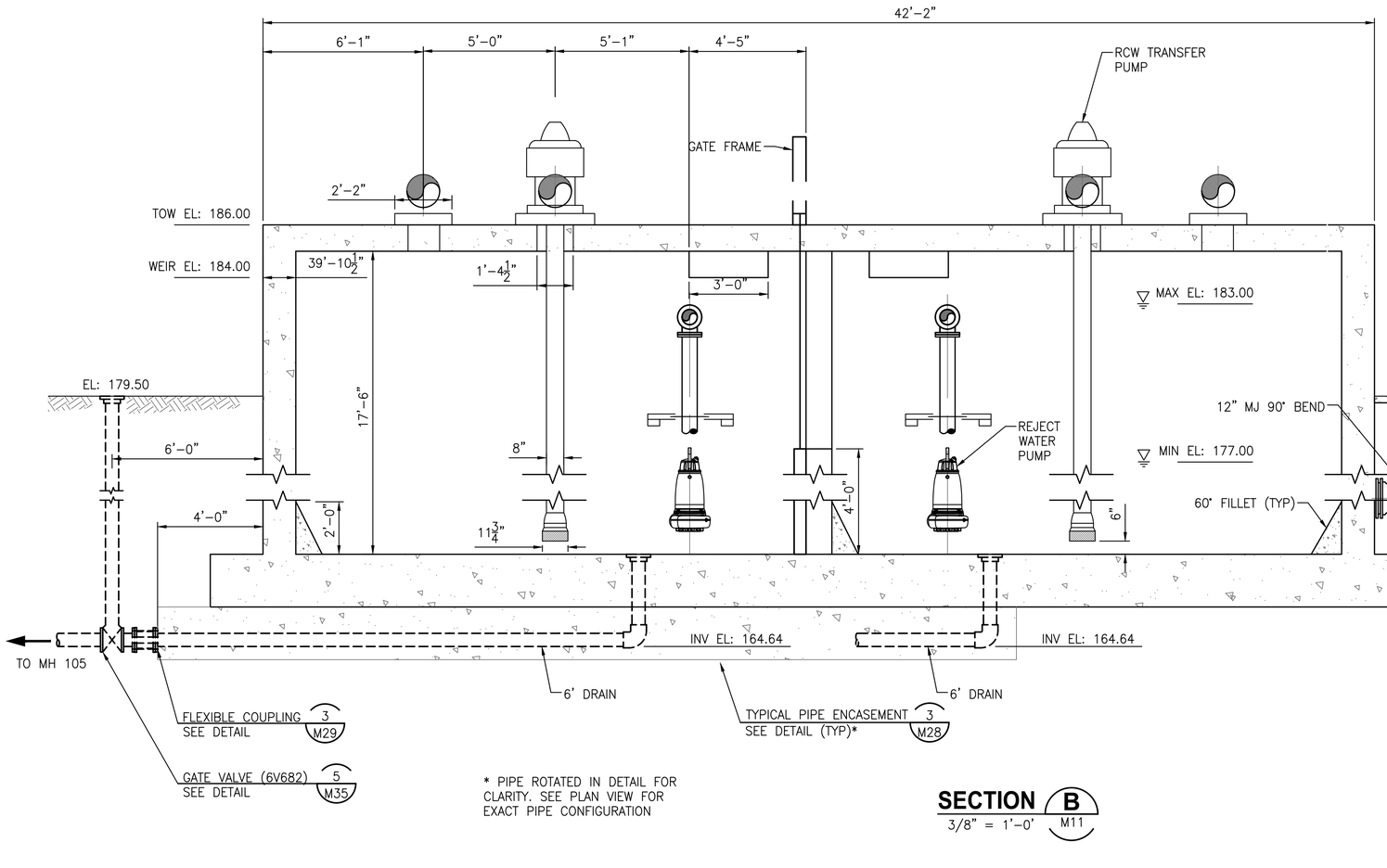
GRAPHIC SCALE

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SCALE IN FEET

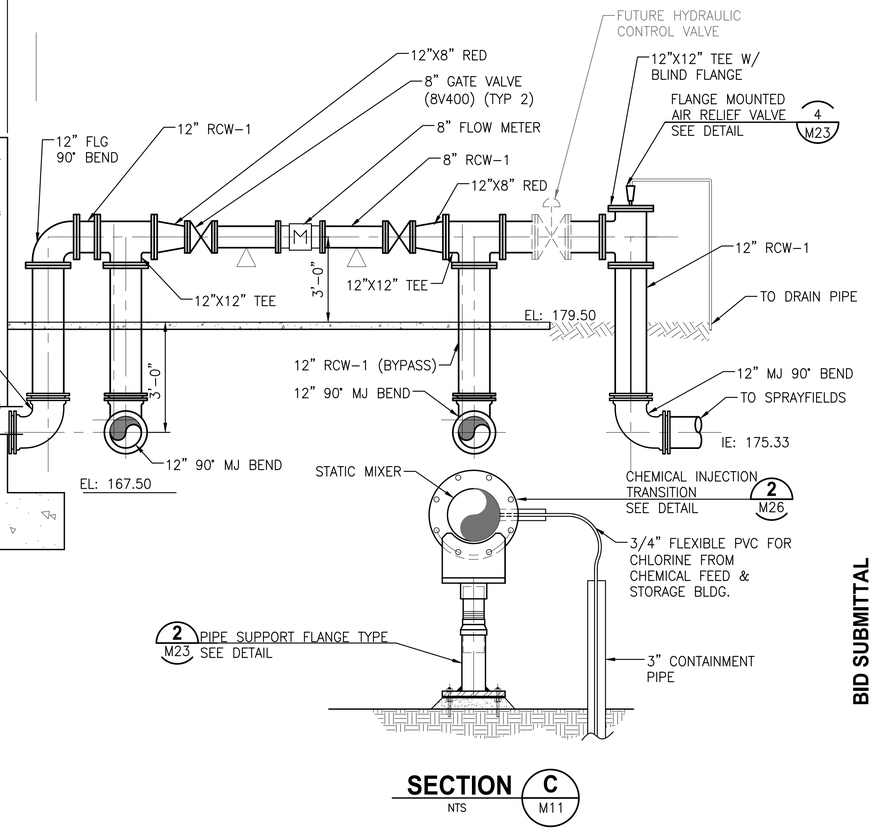


SECTION A
3/8" = 1'-0" M11



* PIPE ROTATED IN DETAIL FOR CLARITY. SEE PLAN VIEW FOR EXACT PIPE CONFIGURATION

SECTION B
3/8" = 1'-0" M11



SECTION C
NTS M11

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COLUMBIA COUNTY, FLORIDA

CHLORINE CONTACT TANKS SECTIONS

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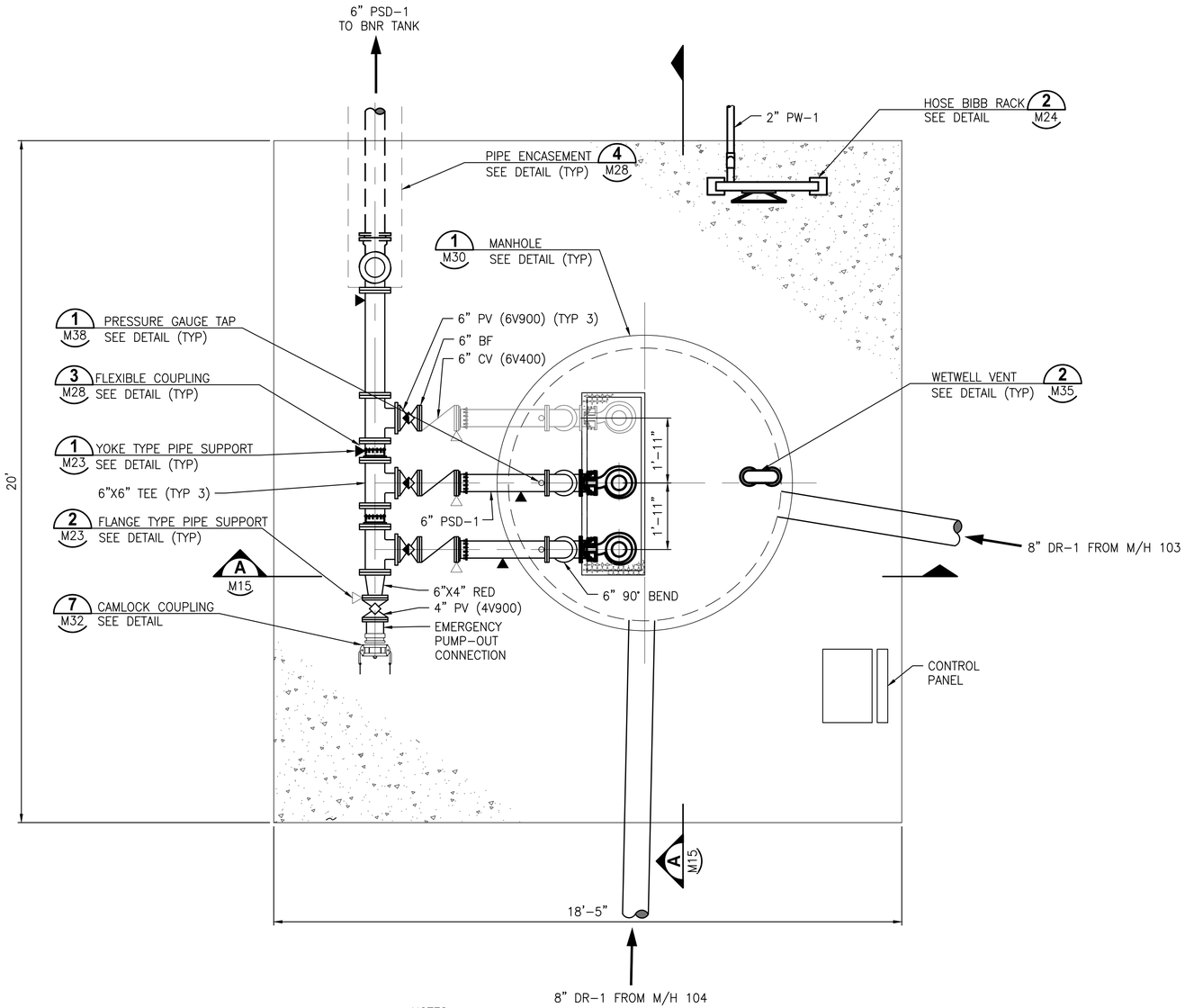
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GRAPHIC SCALE

0 1 2 4

SCALE IN FEET

NOTES:

1. ALL PUMP RAIL, PIPE SUPPORT, FASTENERS AND MATERIAL SHALL BE ANSI TYPE 304 SS
2. COORDINATE MOUNTING AND INSTALLATION OF PUMP GUIDE RAIL HANDLE WITH PUMP MANUFACTURER
3. COORDINATE ACCESS HATCH SIZE AND LOCATION W/ PUMP MANUFACTURER.
4. FIELD VERIFY ALL PIPE PENETRATION LOCATIONS AND SIZES.

PLANT DRAIN PUMP STATION PLAN

1/2" = 1'-0"

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

PLANT DRAIN PUMP STATION PLAN

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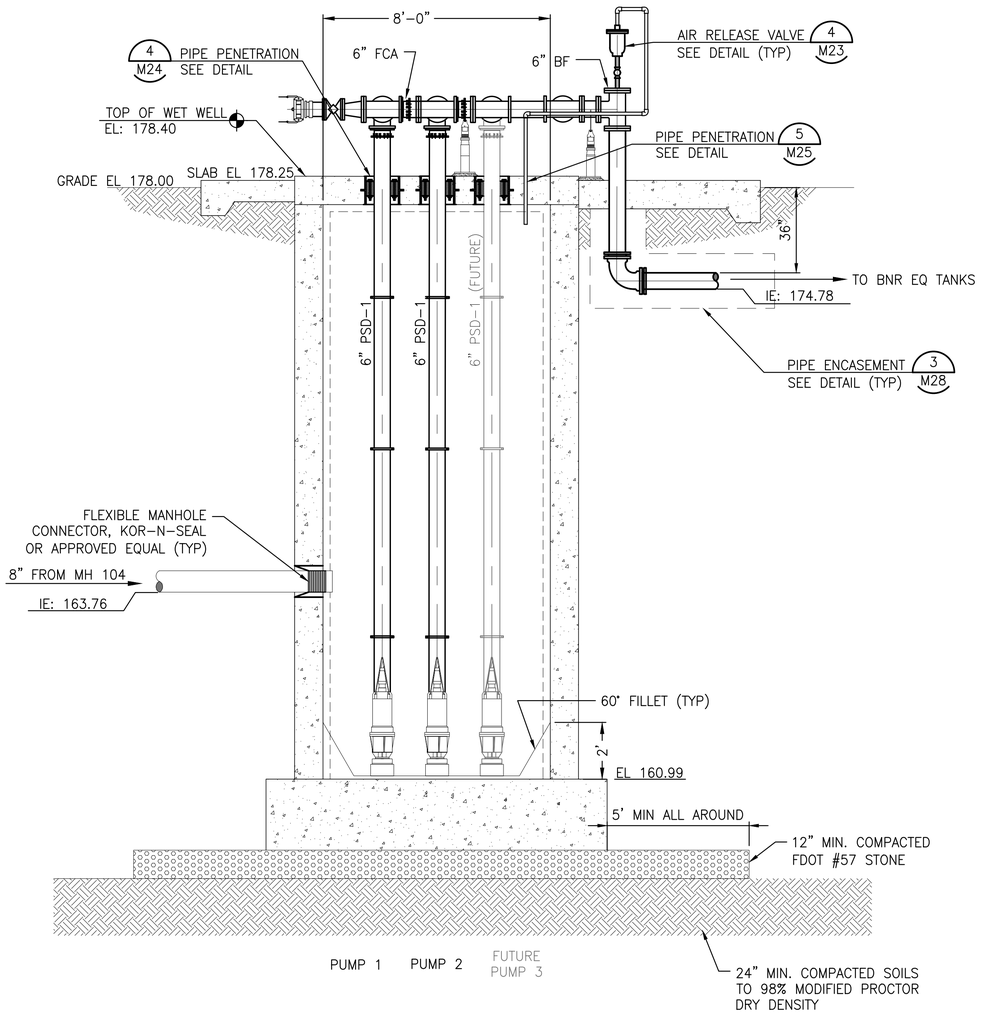
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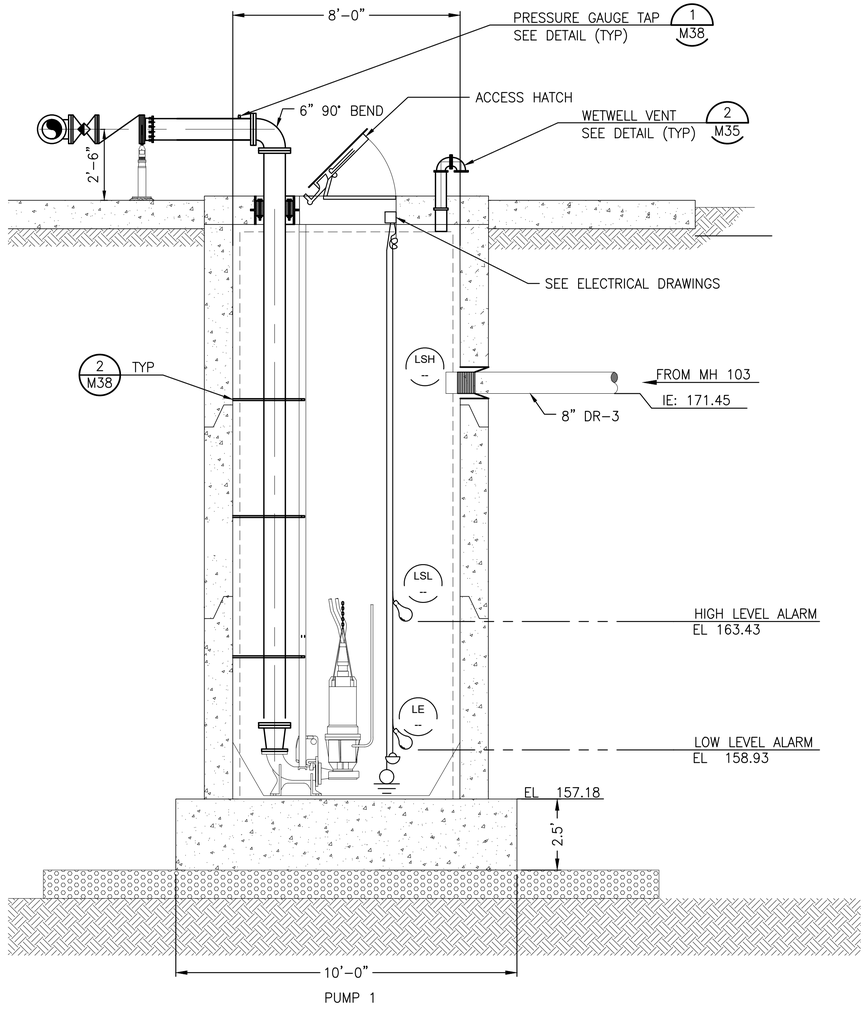
GRAPHIC SCALE

0 1 2 4

SCALE IN FEET



SECTION A (A – –)
3/8" = 1'-0"



SECTION B (B – –)
3/8" = 1'-0"

NOTES:

1. ALL PUMP RAIL, PIPE SUPPORT, FASTENERS AND MATERIAL SHALL BE ANSI TYPE 304 SS.
2. COORDINATE MOUNTING AND INSTALLATION OF SCUM PUMP GUIDE RAIL HANDLE WITH SCUM PUMP MANUFACTURER.
3. COORDINATE ACCESS HATCH SIZE AND LOCATION W/ PUMP MANUFACTURER.
4. WETWELL TO BE CONSTRUCTED USING ARMOROCK.
6. EXTERIOR OF WETWELL SHALL BE PAINTED WITH COAL TAR EPOXY AS SPECIFIED.
7. ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE SHALL BE PAINTED PER SPECIFICATIONS.
8. PROVIDE SPARK-PROOF CONTACT BETWEEN PUMPS AND GUIDE RAIL SYSTEM.
9. GROUT TOP OF PIPE PENETRATION HOLES FLUSH WITH TOP OF WETWELL PRECAST LID.

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

PLANT DRAIN PUMP STATION SECTIONS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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NOTE:

1. CHEMICAL CONTAINMENT VOLUME CALCULATIONS:
   - MINIMUM REQUIRED CONTAINMENT VOLUME: 1.5 X CHEMICAL STORAGE = 1.5 X 5100 GALLONS: 7650 GALLONS
   - ACTUAL CONTAINMENT VOLUME: CONTAINMENT SURFACE AREA X CONTAINMENT WALL HEIGHT = 606 FT² X 2 FT = 1212 FT³ = 9065 GALLONS
2. COAT CONTAINMENT AREA FLOORS, WALLS AND TOP OF WALLS W/ SYSTEM 32 FROM SPECIFICATION 09900.

GRAPHIC SCALE
0 1 2 4
SCALE IN FEET

33'-8"
12'-0" ACCESS DRIVEWAY
PAVED
1-1/2" MALE QUICK CONNECT W/ CAP
CONTAINMENT AREA LEVEL SWITCH, SEE ELECTRICAL AND INSTRUMENTATION DRAWINGS
EMERGENCY SHOWER AND EYE WASH SEE DETAIL (TYP) 1/M25
1-1/2" PW-1
1-1/2" DR-3
1-1/2" PW-1
LSH 1-1/2"
SS-1
2/M24 HOSE BIB SEE DETAIL (TYP)
2" MALE QUICK CONNECT W/ CAP @ 3' AFF
2" BALL VALVE (2V212) (TYP)
2/M32 YOKE TYPE PIPE SUPPORT SEE DETAIL (TYP)
C/M17
3'-0"
SEE NOTE 2
2" BAG FILTER
2" CL FILL
3" CL-1 OVERFLOW
SUMP W/ FRP GRATING
L1
LEVEL INDICATOR (TYP) L1
2" FLG FILL NOZZLE W/ 2" DROP PIPE (TYP)
LIT LE
1'-0" MIN
2550 GALLON BULK STORAGE TANK 1
ULTRASONIC LEVEL SENSOR, SEE ELECTRICAL AND INSTRUMENTATION DRAWINGS
4" VENT
2550 GALLON BULK STORAGE TANK 2
2" CL DRAIN
2" FLG TANK NOZZLE (TYP)
24" MANWAY (TYP)
3-WAY SS CABLE RESTRAINT SYSTEM W/ CLIP (TYP)
2" DIAPHRAM VALVE (2V525)
2" PVC FLEXIBLE HOSE CONNECTION IN VERTICAL (TYP)
A/M17
1" VENT
B/M17
1/M17 TANK OUTLET NOZZLE CONCRETE BLOCK-OUT SEE DETAIL (TYP)
SODIUM HYPOCHLORITE PUMP SKID. SEE SPECIFICATIONS
PI PE METERING PUMP #1
PI PE METERING PUMP #2
PI PE METERING PUMP #3
PIPE ENCASEMENT
SS-2
EMERGENCY SHOWER AND EYEWASH 1/M25
(2) 3/4" TUBING INSIDE 3" CONTAINMENT TO CHLORINE CONTACT TANK
TO CHLORINE CONTACT TANKS
26'-8"
CHEMICAL CONTAINMENT WALL (SEE NOTE 1)
2" PW-1
TO CHLORINE CONTACT TANKS

TIE INTO DRAIN FOR ANALYZER STRUCTURE
1" SA-2 FROM INFLUENT PUMP STATION
1-1/2" DR-3
3/4" SA-1 TO COMPOSITE SAMPLER
INFLUENT COMPOSITE SAMPLER
TWO COMPARTMENT COMMERCIAL 16 GAUGE SS UTILITY SINK
1" SA-1 TO pH & CONDUCTIVITY ANALYZERS
ANALYZER BOARD & TROUGH. SEE SHEET M33
20'-0"
2" DR-3
FRP ANALYZER STRUCTURE SEE DETAIL 1/M33
1" SA-1 TO CHLORINE RESIDUAL & pH ANALYZERS
3/4" SA-1 TO COMPOSITE SAMPLER
EFFLUENT COMPOSITE SAMPLER
1" BALL VALVE (1V200)
6" DR-3
15'-0"
1" PW-1
(2) 3/4" SA-1 FROM CHLORINE CONTACT CHAMBER

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
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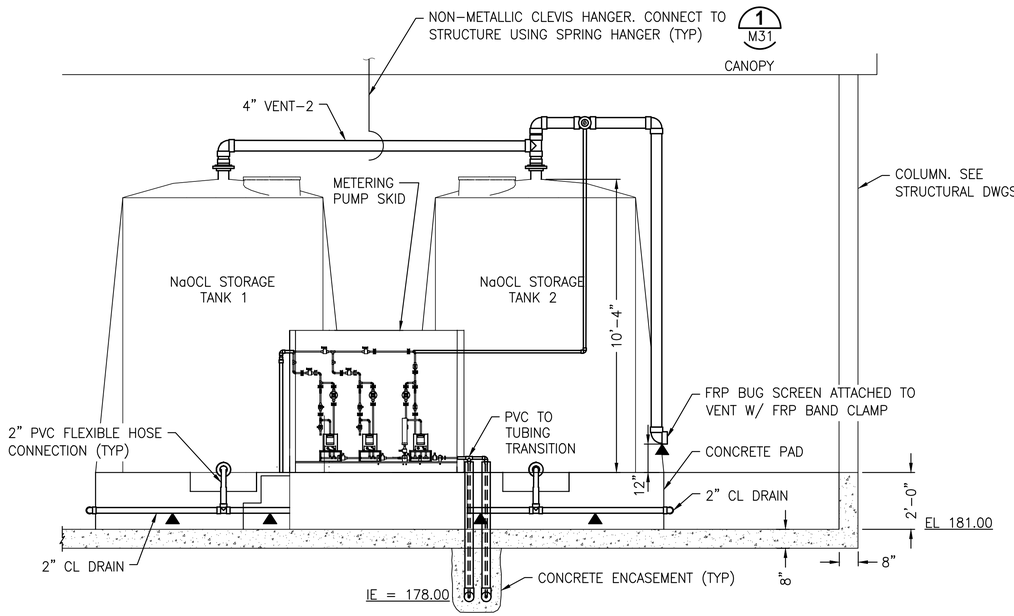
NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

CHEMICAL STORAGE AND FEED SYSTEMS PLAN

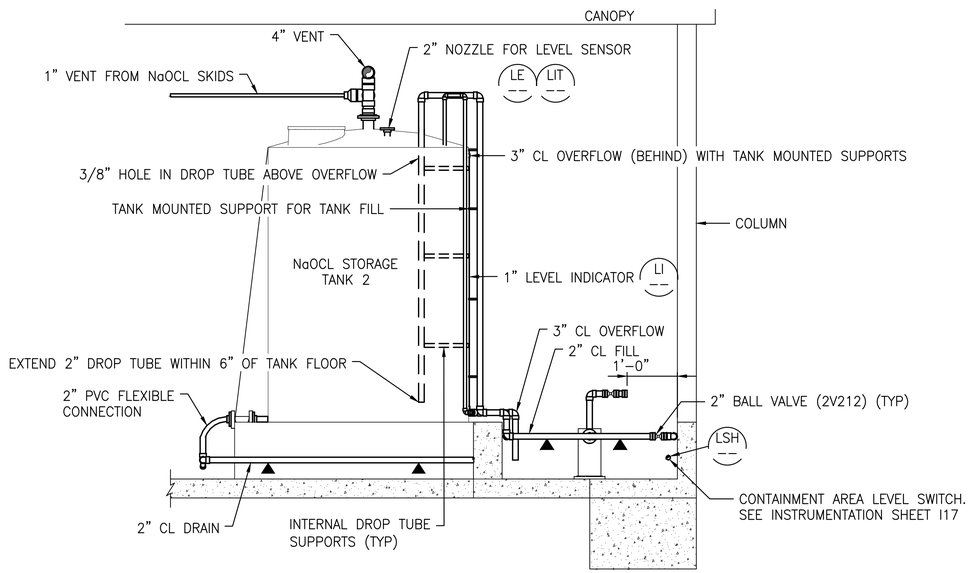
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PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
DWG NO: M16

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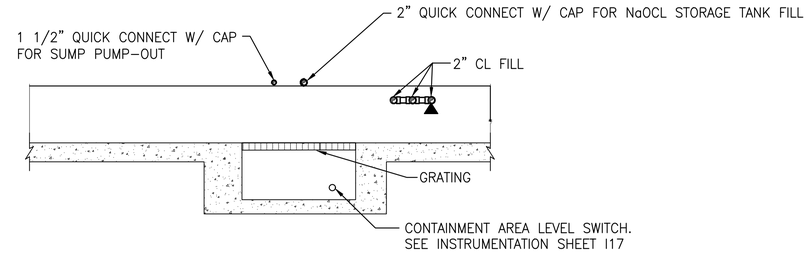


SECTION A (M16)
3/8"=1'-0"

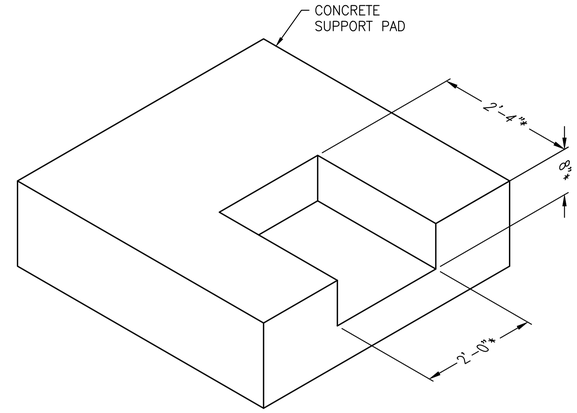


SECTION B (M16)
3/8"=1'-0"

GRAPHIC SCALE
0 1 2 4
SCALE IN FEET



SECTION C (M16)
3/8"=1'-0"



TANK OUTLET NOZZLE CONCRETE BLOCK OUT DETAIL (1 / M16)
NTS

NOTES:

1. * DENOTES VERIFICATION AND/OR COORDINATION BY CONTRACTOR IS REQUIRED WITH RESPECT TO APPROVED SHOP DRAWING PRIOR TO CONSTRUCTION.
2. SEE STRUCTURAL DWGS FOR PAD DIMENSIONS.

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

CHEMICAL STORAGE AND FEED SYSTEMS SECTIONS

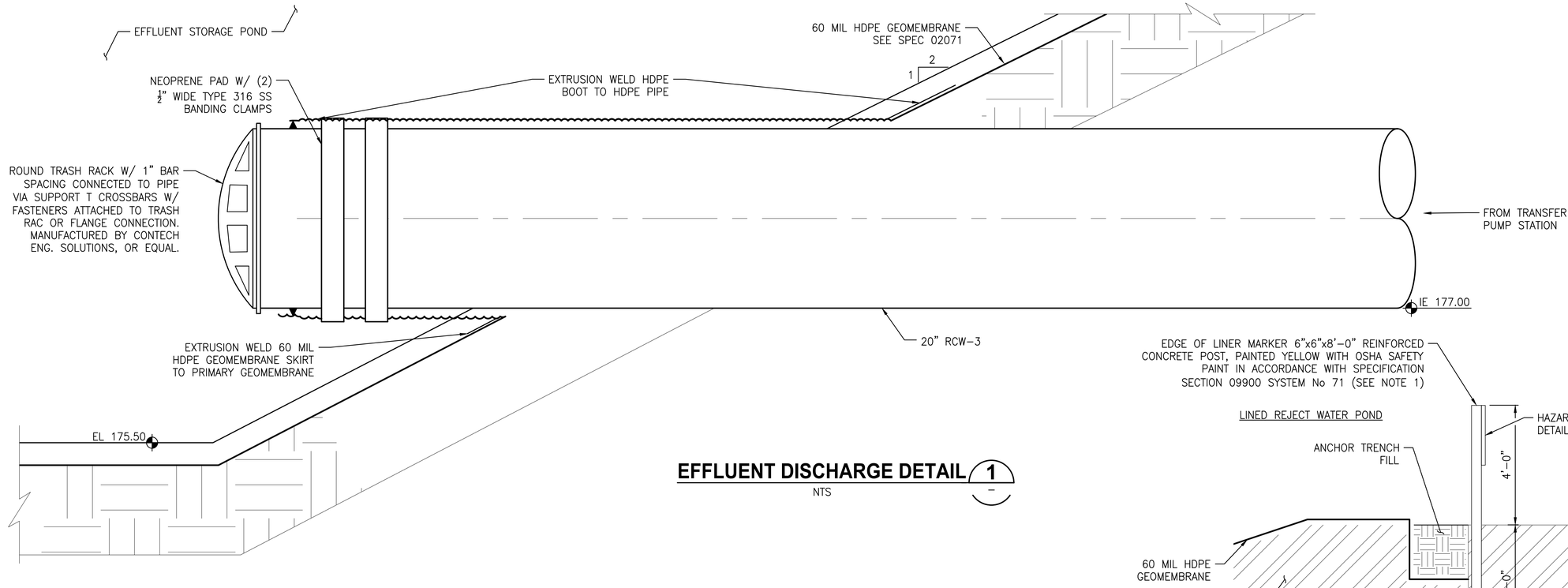
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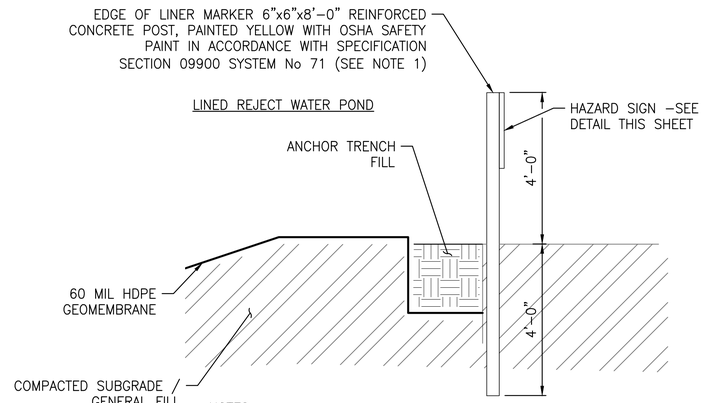
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EFFLUENT DISCHARGE DETAIL 1

NTS

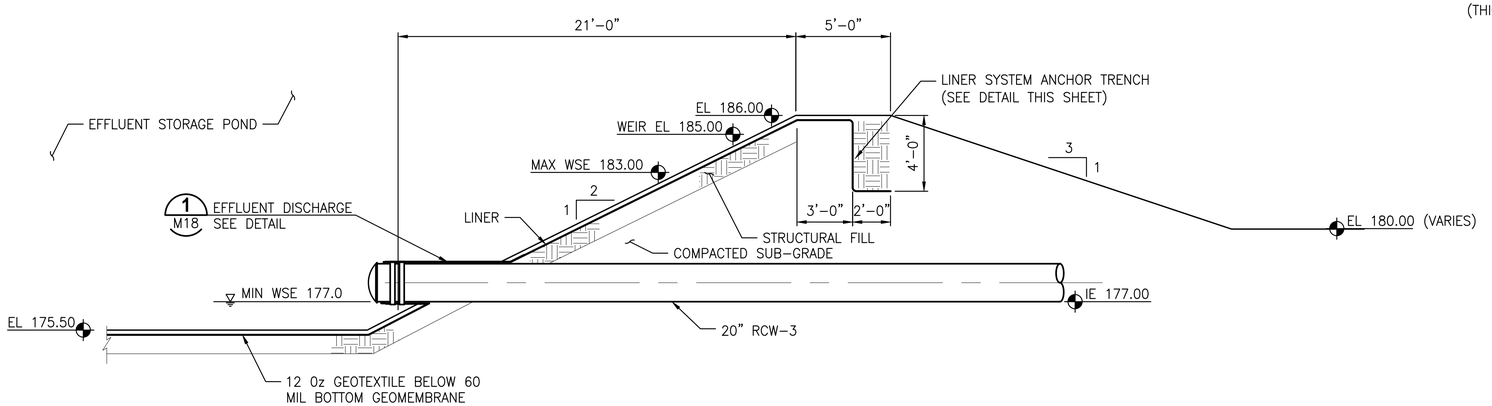


NOTES:

1. INSTALL POSTS WITH WARNING SIGNS AT 100'-0" INTERVALS AROUND PERIMETER.

LINER SYSTEM ANCHOR TRENCH DETAIL

NTS



NOTE:

FOR EFFLUENT POND DETAILS SEE SHEET C18

SECTION A

1/4" = 1'-0"



DIMENSIONS:	2' WIDE BY 2' HIGH
TEXT SIZES:	VARIES
COLORS:	STANDARD OSHA DANGER SIGN COORDINATE W/ ENGINEER FOR COLOR SCHEME
SIGN STYLE:	PER FDOT SIGN SPECIFICATION 700
MOUNTING:	SECURED TO NEW FENCE WITH MINIMUM SIX (6) STAINLESS STEEL FASTENERS
SUBMITTALS:	SUBMIT FABRICATION DRAWINGS FROM FDOT APPROVED SIGN VENDOR TO OWNER FOR APPROVAL BEFORE FABRICATION

NOTES:

1. INSTALL SIGNS ON EDGE OF LINER POSTS.

WARNING SIGN DETAIL

NTS

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LTR.	DATE	REVISIONS	BY	APPRD.

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NORTH FLORIDA MEGA INDUSTRIAL PARK
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COLUMBIA COUNTY, FLORIDA

POND LINER SECTION AND DETAIL

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DWG NO: M18

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NOTES:

1. THERE ARE FOUR MONITORING WELLS (MWB–1AS, MWI–2S, MWC–3S, AND MWC–4S) TO BE INSTALLED. THERE ARE TWO PIEZOMETERS TO BE ABANDONED. ALL LOCATIONS ARE SHOWN ON THIS SHEET.

2. BEFORE THE PROPOSED MONITORING WELLS ARE INSTALLED, AN SPT BORING WILL BE PERFORMED TO ACCURATELY DETERMINE THE LITHOLOGY OF THE ZONE TO BE MONITORED. TEST BORING METHODOLOGY SHOULD BE IN ACCORDANCE WITH ASTM D1586. THE SPT BOREHOLE WILL BE USED FOR INSTALLING THE WELLS.

3. THE WELLS WILL BE INSTALLED BY A LICENSED WATER–WELL CONTRACTOR AND THE INSTALLATION SUPERVISED BY A GEOLOGIST OR ENGINEER. WE RECOMMEND INSTALLING THE WELLS USING HOLLOW–STEM AUGERS. BEFORE THE WELLS ARE DRILLED OR INSTALLED, ALL DRILLING EQUIPMENT WILL BE DECONTAMINATED BY STEAM CLEANING.

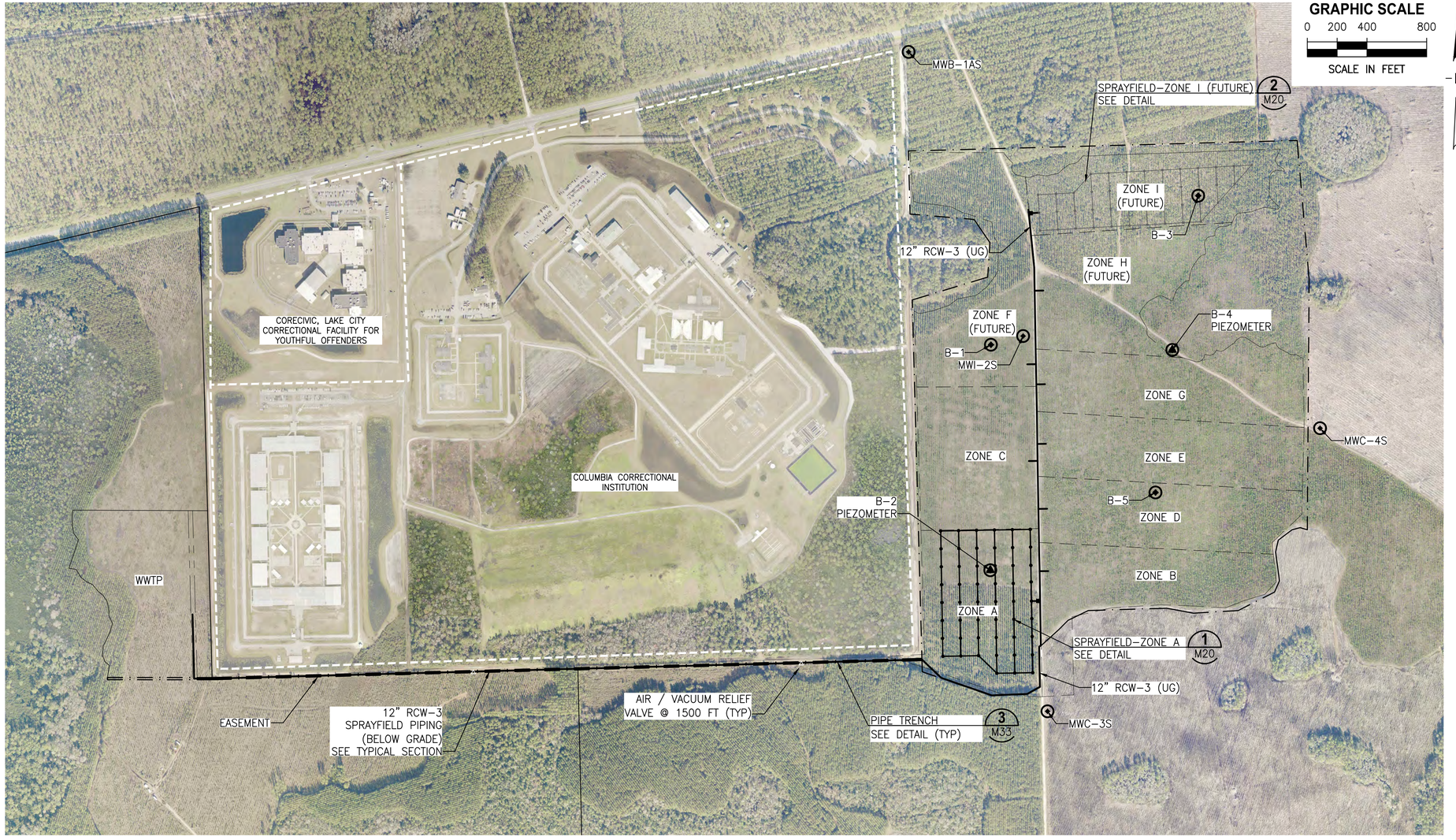
4. THE WELLS WILL BE 2 INCHES IN DIAMETER AND WILL BE CONSTRUCTED USING SCHEDULE 40 PVC PIPE WITH THREADED COUPLINGS. THE WELL SCREEN WILL CONSIST OF APPROXIMATELY 10 FEET OF 0.010–INCH SLOTTED PVC SCREEN. THE TOTAL DEPTH OF THE WELL SHOULD BE APPROXIMATELY 20 TO 30 FT–BLS.

5. THE ANNULAR SPACE FOR THE WELLS WILL BE PACKED WITH 20/30 SILICA FILTER SAND THAT SHOULD EXTEND AT LEAST 2 FEET ABOVE THE TOP OF THE WELL SCREEN. A 30/60 FINE–SILICA–SAND SEAL AND/OR BENTONITE SEAL WILL BE PLACED ABOVE THE FILTER PACK TO A MINIMUM THICKNESS OF 2 FEET. THE REMAINING ANNULAR SPACE ABOVE THE SEAL SHOULD BE GROUTED WITH CEMENT/BENTONITE GROUT (MAXIMUM 4–PERCENT BENTONITE) TO A MINIMUM OF 1 FT–BLS.

6. THE WELLS CASING SHOULD EXTEND APPROXIMATELY 2.5 FEET ABOVE GROUND SURFACE, AND A 1/8–INCH VENT HOLE SHOULD BE DRILLED AT THE TOP OF EACH WELL CASING. A LOCKING PROTECTIVE COVER AND CONCRETE PAD MEASURING 2 FEET BY 2 FEET BY 6 INCHES WILL BE INSTALLED AROUND THE WELL HEAD. TWO BOLLARDS SHALL BE INSTALLED IN FRONT OF EACH INSTALLATION. ALL WELLS SHALL BE LABELED. THE TOC ELEVATION AND HORIZONTAL LOCATION WILL BE SURVEYED BY A FLORIDA–REGISTERED SURVEYOR. THE MONITORING WELL WILL BE DEVELOPED USING THE PUMP–AND–SURGE METHOD UNTIL THE WELL PRODUCES CLEAN, CLEAR, SAND–FREE WATER.

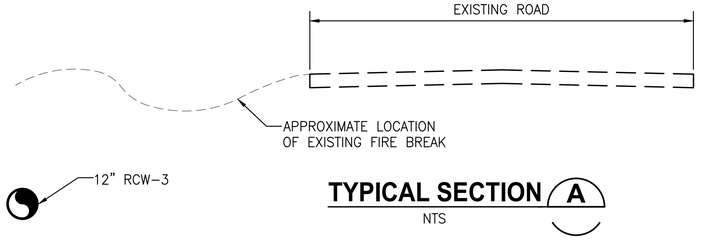
7. THE TWO PIEZOMETERS SHALL BE PLUGGED IN ACCORDANCE WITH F.A.C. 40B–3 BY FILLING THEM FROM BOTTOM TO TOP WITH GROUT. THE PLUGGING SHALL BE TO RESTORE OR IMPROVE THE HYDROLOGIC CONDITIONS WHICH EXISTED BEFORE THE WELL WAS CONSTRUCTED. THE WORK SHALL BE ACCOMPLISHED BY A LICENSED WATER WELL CONTRACTOR.

8. CONTRACTOR TO PROVIDE FOUR ADVISORY SIGNS TO DESIGNATE PROJECT IS A "PART II RESTRICTED ACCESS RECLAIM WATER SPRAYFIELD." POST AND INSTALL SIGNS AT SITE BOUNDARIES/ROADWAY ENTRANCES. CONSULT WITH ENGINEER FOR FINAL LOCATION.



SPRAYFIELD PLAN

1"=400'



TYPICAL SECTION A

NTS

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DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

SPRAYFIELD PLAN

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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PROJECT NO:	DATE:
03780–001–01	APRIL 2022
INDEX NO:	DWG NO: M19

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SPRAYFIELD NOTES:

1. DRAWING M19 SHOWS THE SPRAYFIELD PLAN AND THE APPROXIMATE IRRIGATION ZONES.

2. SPRAYFIELD BOUNDARY IS PROVIDED FOR GRAPHICAL PURPOSES ONLY. THE DATA PROVIDED ON THE DRAWING IS THE PRELIMINARY EASEMENT PROVIDED BY WEYERHAUSER AND DOES NOT REPRESENT A SURVEY.

3. THE CONTRACTOR SHALL SURVEY AND STAKE THE SPRAYFIELD EASEMENT BOUNDARY ON THE SITE PRIOR TO CONSTRUCTING THE RECLAIMED WATER MAIN OR SPRAYFIELD IRRIGATION SYSTEM.

4. THE SPRAYFIELD HAS 9 IRRIGATION ZONES WHICH ARE 18 +/- 2.5 ACRES. THE CONTRACTOR WILL INSTALL SIX ZONES (A, B, C, D, E AND G) AS PART OF THIS CONTRACT. ZONES F, H AND I WILL BE INSTALLED IN THE FUTURE.

5. THE SPRAYFIELD BOUNDARY AND ZONES WERE DRAWN TO PROVIDE A 50 FT BUFFER FROM WETLANDS AS SHOWN ON DRAWING M19.

6. THE IRRIGATION SYSTEM WITHIN EACH IRRIGATION ZONE CONSISTS OF A LOOPED ABOVEGROUND PIPING SYSTEM WITH LATERALS FEEDING FIXED SPRAYHEADS.

7. ALL SPRAYFIELD PIPING SHALL BE HIGH DENSITY POLYETHYLENE (HDPE) AND SHALL MEET THE FOLLOWING SPECIFICATIONS:

   A. HDPE RESIN USED IN THE MANUFACTURE OF THE HDPE PIPE AND FITTINGS SHALL BE A HIGH DENSITY, EXTRA-HIGH MOLECULAR WEIGHT RESIN THAT IS CLASSIFIED AS A TYPE III, GRADE P34, CLASS C, CATEGORY 5, BY ASTM D1248. CELL CLASSIFICATION BY ASTM 3350 SHALL BE 34534C AND SHALL BE RATED AS PE 3408 BY THE PLASTIC PIPE INSTITUTE.

   B. THE HDPE PIPE SHALL HAVE AN OUTSIDE DIAMETER THAT CORRESPONDS TO THAT OF STEEL PIPE (IPS) OF THE SAME NOMINAL DIAMETER.

   C. THE HDPE PIPE SHALL HAVE THE DIMENSION RATIOS SPECIFIED AS FOLLOWS AND BE MANUFACTURED BY PLEXCO, DRISCOPIPE OR AN APPOVED EQUAL.

   D. ALL HDPE PIPE 2 INCH TO 6 INCH SHALL BE DR 17 AND INSTALLED ABOVE GRADE. ALL HDPE PIPE 8 INCH TO 12 INCH SHALL BE DR 17 AND INSTALLED BELOW GRADE.

   E. ALL HDPE FITTINGS AND ADAPTERS SHALL BE RATED FOR THE FULL WORKING PRESSURE OF THE HDPE PIPING.

   F. ALL REQUIRED REDUCERS, TEES AND FITTINGS ARE NOT SHOWN. PIPING SIZE CHANGES SHALL BE MADE AT PIPING JUNCTIONS WITH JUNCTION FITTINGS (E.G. TEES) OF SAME SIZE AS THE LARGEST CONNECTED LINE AND REDUCERS SIZED AS REQUIRED.

   G. THE MINIMUM ALLOWABLE BENDING RADIUS FOR ALL HDPE PIPING SHALL BE 25% IN EXCESS OF THE MANUFACTURER'S RECOMMENDED MINIMUM VALUE.

8. SPRAYHEAD IS SENNINGER MODEL 7025RD-1 WITH ¼ INCH NOZZLE (#16), OR APPROVED EQUAL. SPRAYHEAD WILL BE MOUNTED AT 6 FT HEIGHT, TO PROVIDE A SPRAY DIAMETER OF 131 FT AT A BASE PRESSURE OF 50 PSI W/ FLOW OF 10 GPM/HEAD.

9. DRAWING M17 SHOWS A TYPICAL PIPING LAYOUT FOR ZONE A. THE CONTRACTOR WILL FIELD LOCATE THE SPRAYHEADS TO MEET THE FOLLOWING DESIGN CRITERIA:

   A. SPRAYHEADS GRID SPACING AT 120 FT X 120 FT.

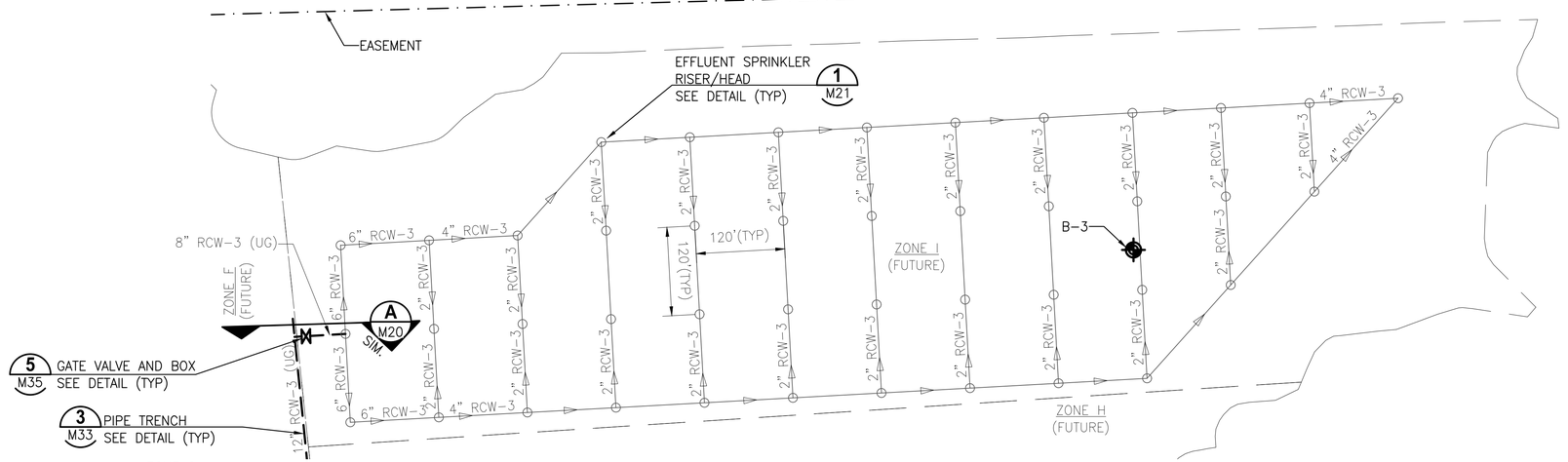
   B. SPRAYHEADS WILL BE INSTALLED TO MAINTAIN A 50 FT BOUNDARY TO THE OUTER PERIMETER OF THE SPRAYFIELD.

   C. THE ZONES WILL BE CONTROLLED BY A SINGLE VALVE LOCATED ALONG THE EXISTING FORESTRY ROAD THROUGH THE CENTER OF THE SPRAYFIELD.

   D. THE CONTRACTOR WILL FIELD ADJUST THE SPRAYHEADS SO THAT THEY ARE PLACED 170 FT FROM GOPHER TORTOISE BURROWS. THE KNOWN BURROWS ARE LOCATED ON DRAWING M19. THE CONTRACTOR WILL INFORM THE ENGINEER IF ANY ADDITIONAL BURROWS OR SUSPECTED BURROWS ARE NOTED DURING CONSTRUCTION.

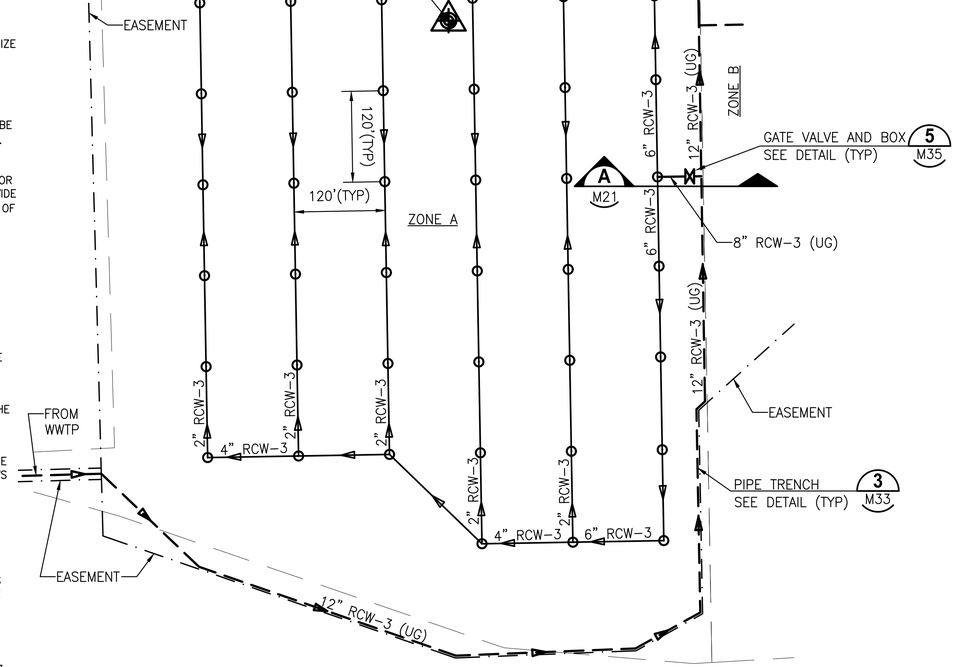
10. PIEZOMETERS AND SOIL BORINGS SHALL BE PLUGGED IN ACCORDANCE WITH F.A.C. 40B-3 BY FILLING THEM FROM BOTTOM TO TOP WITH GROUT. THE PLUGGING SHALL BE TO RESTORE OR IMPROVE THE HYDROLOGIC CONDITIONS WHICH EXISTED BEFORE THE WELL WAS CONSTRUCTED. THE WORK SHALL BE ACCOMPLISHED BY A LICENSED WATER WELL CONTRACTOR.

11. CONTRACTOR TO NOTIFY OWNER AND ENGINEER 14-DAYS PRIOR TO INSTALLATION OF GROUNDWATER MONITORING WELLS AND FOLLOW CONSTRUCTION AND TESTING REQUIREMENTS IN SECTION III A., 1 THROUGH 7 FROM PERMIT CONDITIONS IN FDEP WWTF OPERATING PERMIT NUMBER: FLAB07233.



SPRAYFIELD DETAIL-ZONE I (FUTURE) 2 M19

1"=100'



SPRAYFIELD DETAIL-ZONE A 1 M19

1"=100'

GRAPHIC SCALE
0 50 100 200
SCALE IN FEET

-N-

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COLUMBIA COUNTY, FLORIDA

SPRAYFIELD DETAILS

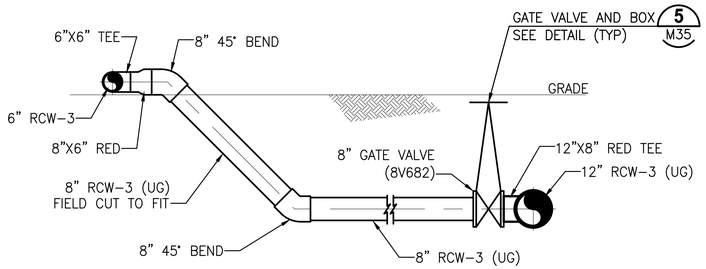
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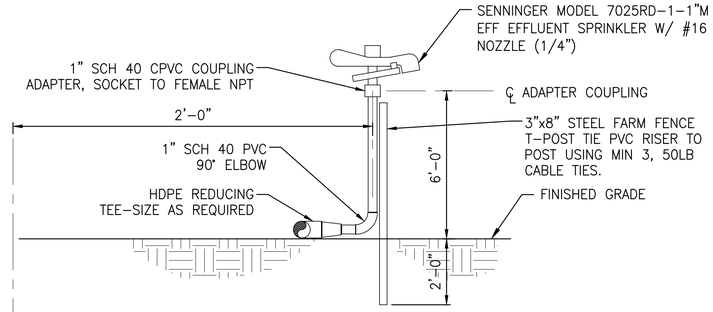
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SECTION A
NTS M20



TYPICAL EFFLUENT SPRINKLER RISER/HEAD DETAIL
NTS 1

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WASTEWATER TREATMENT PLANT
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SPRAYFIELD DETAILS

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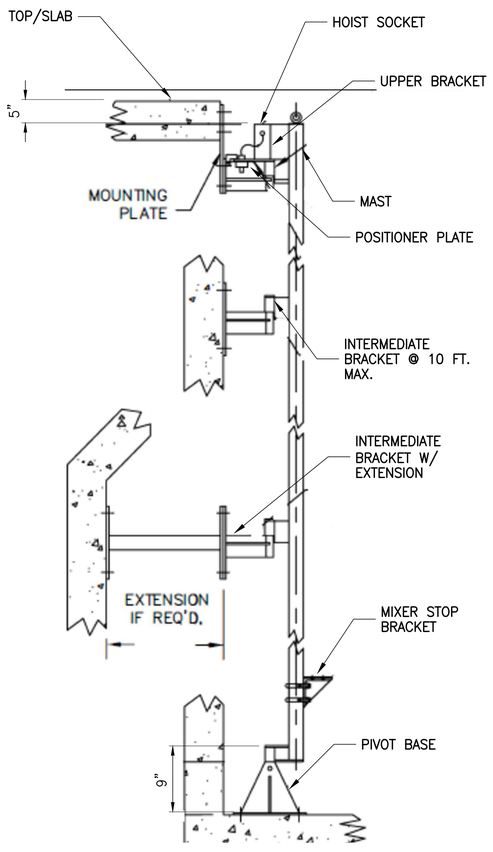
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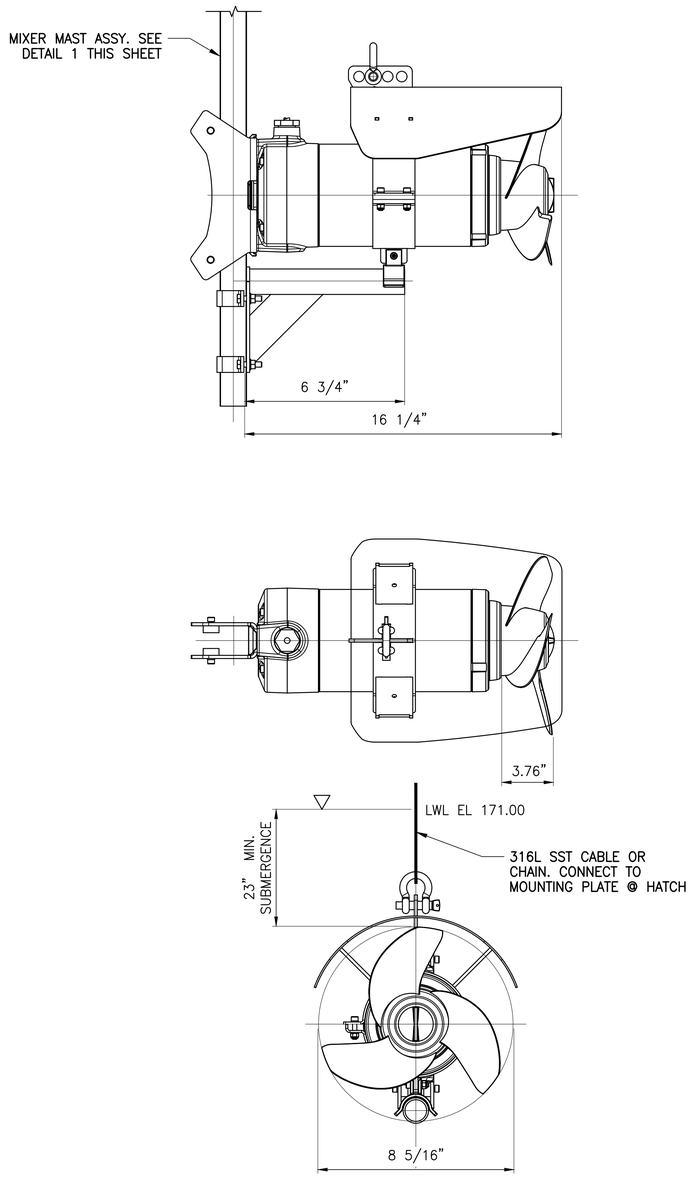
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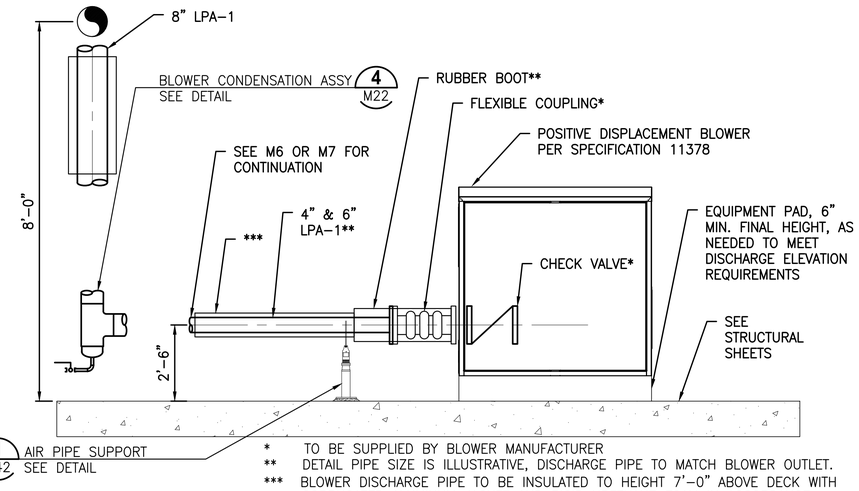
STAINLESS STEEL MIXER MAST ASSEMBLY 1

NTS



LIFT STATION MIXER 2

NTS



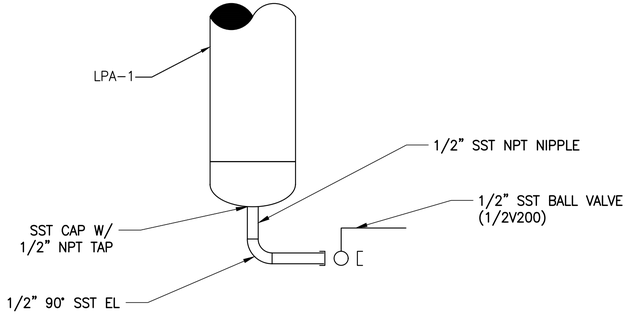
* TO BE SUPPLIED BY BLOWER MANUFACTURER

** DETAIL PIPE SIZE IS ILLUSTRATIVE, DISCHARGE PIPE TO MATCH BLOWER OUTLET.

*** BLOWER DISCHARGE PIPE TO BE INSULATED TO HEIGHT 7'-0" ABOVE DECK WITH CORRUGATED ALUMINUM JACKET AND RIGID URETHANE FOAM IN ACCORDANCE WITH SPECIFICATION 15080.

POSITIVE DISPLACEMENT BLOWER DETAIL 3

NTS



NOTE:

VERTICAL SECTIONS OF PIPE SHALL HAVE BLOWER CONDENSATION ASSEMBLY AT THE LOWEST PORTION OF THE PIPE RISE TO ALLOW FOR DRAINING OF CONDENSATE

BLOWER CONDENSATION ASSEMBLY DETAIL 4

NTS

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

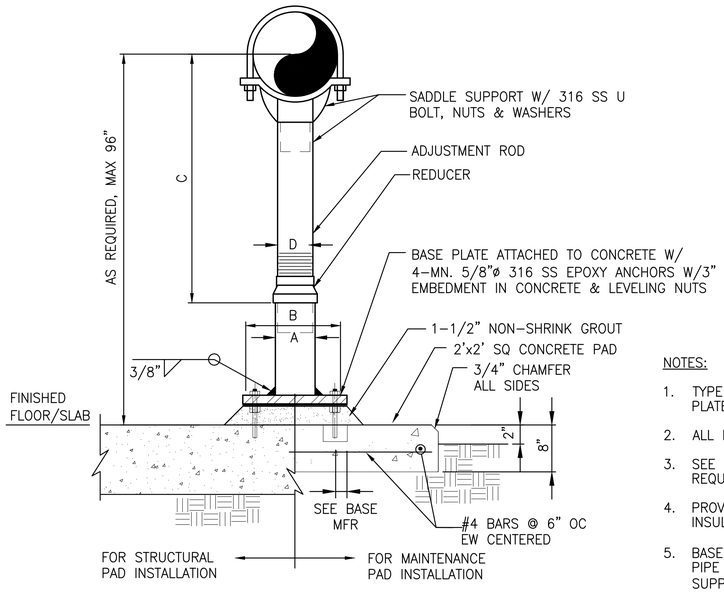
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PIPE SUPPORT - U-BOLT TYPE 1

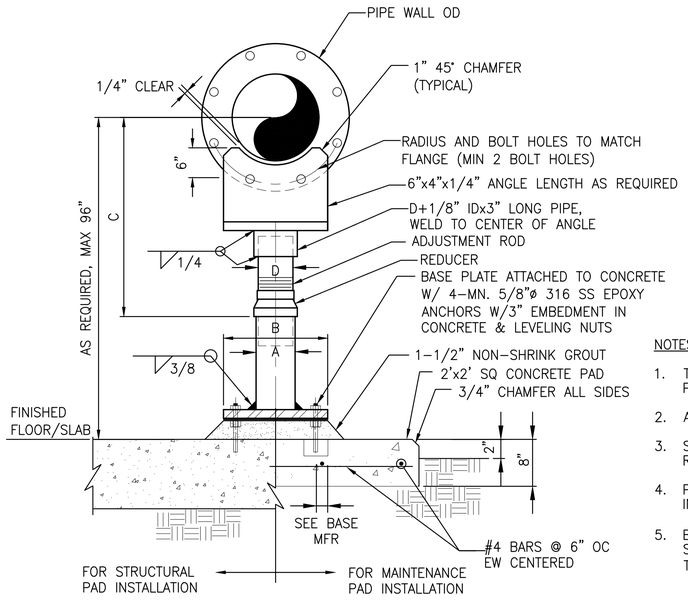
NTS

PIPE SUPPORT DIMENSION TABLE

PIPE SIZE	A	B	C MIN	C MAX	D
INCHES					
4	4	9	9 1/4	14	3
5	4	9	10	14 3/4	3
6	4	9	10 1/2	15 1/4	3
8	4	9	11 3/4	16 1/2	3
10	4	9	13 1/2	18 1/4	3
12	4	9	15	19 3/4	3
14	4	11	16 1/4	20 3/4	3
16	4	11	17 3/4	22 1/4	3
18	6	13 1/2	19 1/2	24	4
20	6	13 1/2	21	25 1/2	4
24	6	13 1/2	23 3/4	28 1/4	4

NOTES:

1. TYPE 1 PIPE SUPPORT: PIPE SADDLE, ADJUSTMENT ROD, BASE PLATE, ETC. SHALL BE 316L SS.
2. ALL HARDWARE SHALL BE 316 SS.
3. SEE PLANS AND SECTIONS FOR PIPE CENTERLINE ELEVATION REQUIREMENTS.
4. PROVIDE RIGID INSULATION PROTECTION SHIELD WHERE PIPING IS INSULATED.
5. BASE PLATES SHALL BE SQUARE AND BE 3/8-INCH THICK FOR PIPE SIZES THROUGH 10-INCH. FOR ALL LARGER PIPES BEING SUPPORTED, THE BASE PLATES SHALL BE 1/2-INCH THICK.



PIPE SUPPORT - FLANGE TYPE 2

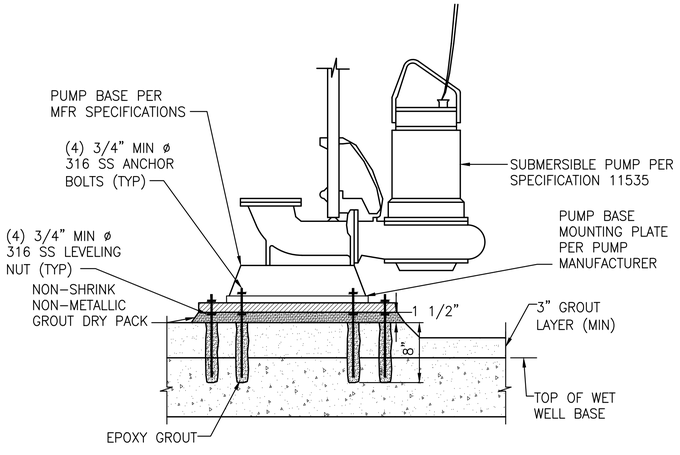
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PIPE SUPPORT DIMENSION TABLE

PIPE SIZE	A	B	C MIN	C MAX	D
INCHES					
4	4	9	9 1/4	14	3
5	4	9	10	14 3/4	3
6	4	9	10 1/2	15 1/4	3
8	4	9	11 3/4	16 1/2	3
10	4	9	13 1/2	18 1/4	3
12	4	9	15	19 3/4	3
14	4	11	16 1/4	20 3/4	3
16	4	11	17 3/4	22 1/4	3
18	6	13 1/2	19 1/2	24	4
20	6	13 1/2	21	25 1/2	4
24	6	13 1/2	23 3/4	28 1/4	4

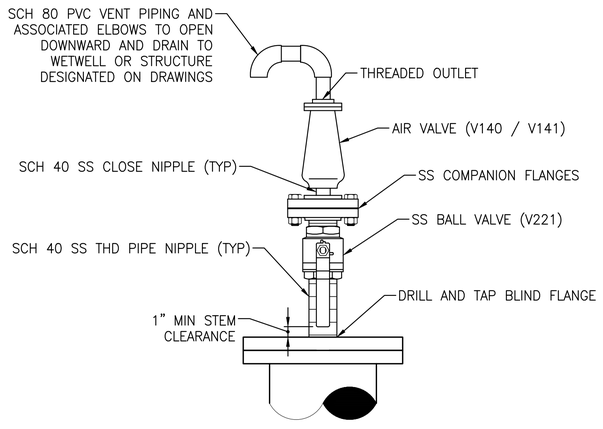
NOTES:

1. TYPE 1 PIPE SUPPORT: PLATE, PIPE SADDLE, ADJUSTMENT ROD, BASE PLATE, ETC. SHALL BE 316L SS.
2. ALL HARDWARE SHALL BE 316 SS.
3. SEE PLANS AND SECTIONS FOR PIPE CENTERLINE ELEVATION REQUIREMENTS.
4. PROVIDE RIGID INSULATION PROTECTION SHIELD WHERE PIPING IS INSULATED.
5. BASE PLATES SHALL BE SQUARE AND BE 3/8-INCH THICK FOR PIPE SIZES THROUGH 10-INCH. FOR ALL LARGER PIPES BEING SUPPORTED, THE BASE PLATES SHALL BE 1/2-INCH THICK.



PUMP BASE DETAIL 3

NTS



NOTES:

1. SEE DRAWINGS FOR AIR VALVE TYPE AND INLET DIAMETER.
2. BALL VALVE AND NIPPLES SHALL HAVE THE SAME DIAMETER AS THE AIR VALVE INLET.
3. VERIFY SIZE OF VALVE PRIOR TO ORDERING ANCILLARY PARTS, DRILLING OR TAPPING.

FLANGE MOUNTED AIR RELEASE VALVE 4

NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

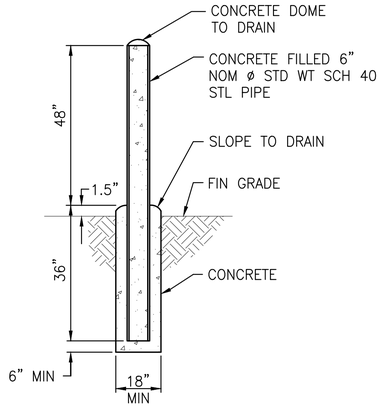
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PROJECT NO: 03780-001-01
INDEX NO:
DATE: APRIL 2022
DWG NO: M23

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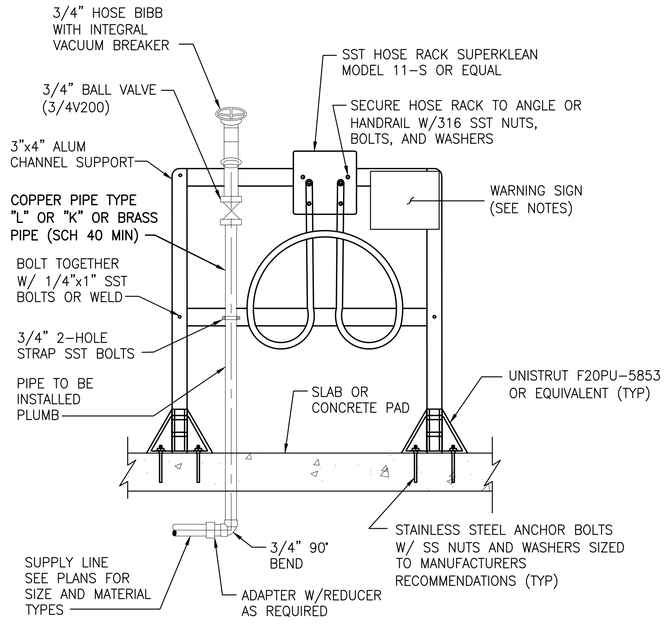


NOTES:

A. ACTUAL INSTALLATION LOCATION OF EACH BOLLARD SHALL BE AS SHOWN ON THE DRAWINGS OR AS DIRECTED IN THE FIELD.

B. PAINT ALL PIPING MATERIALS OSHA SAFETY YELLOW.

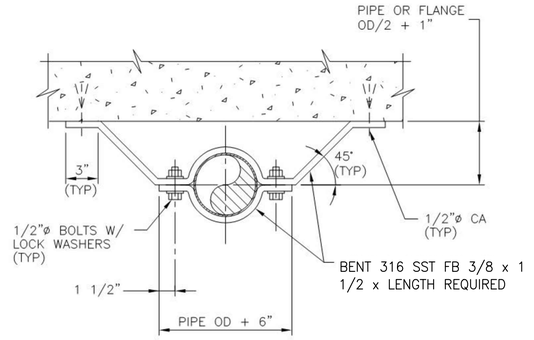
BOLLARD DETAIL 1
NTS



NOTES:

1. PROVIDE 50FT HEAVY DUTY 3/4" HOSE FOR EACH LOCATION.

HOSE BIBB DETAIL 2
NTS



NOTE:

1. ALL HARDWARE IN LIFT STATION WET WELLS SHALL BE 316 STAINLESS STEEL

WALL PIPE SUPPORT DETAIL 3
NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

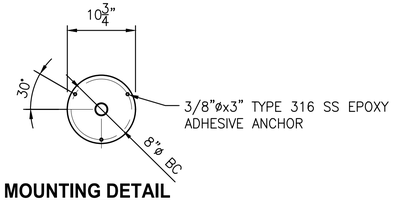
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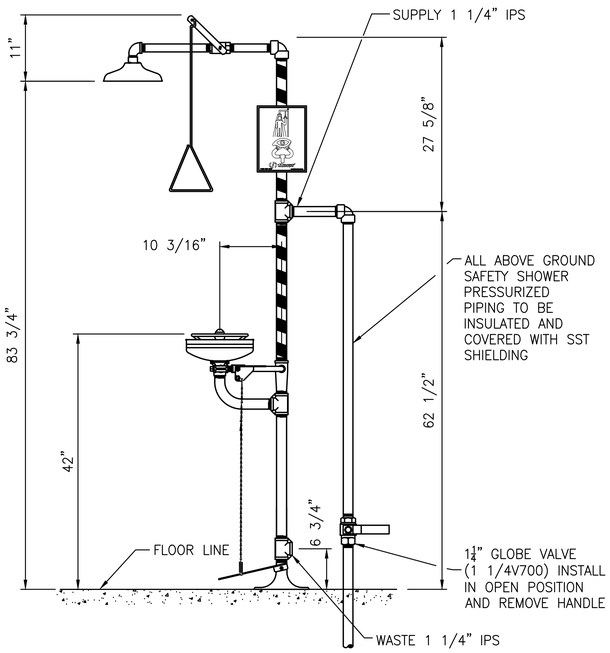
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DATE: APRIL 2022
INDEX NO:
DWG NO: M24

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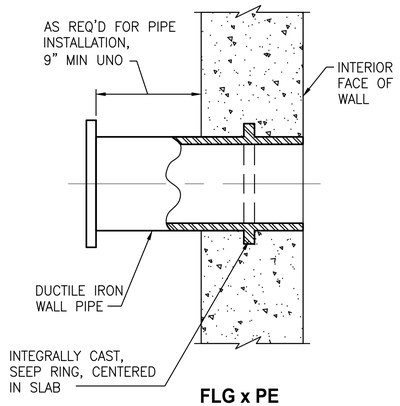


MOUNTING DETAIL

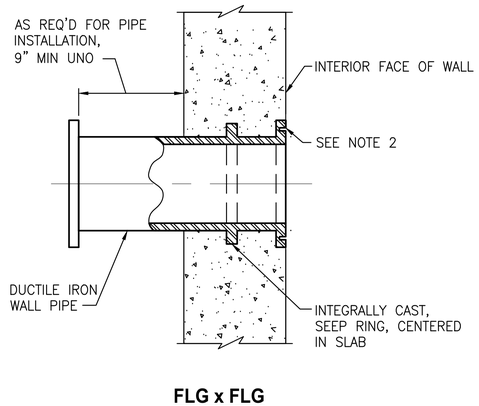


NOTES:
1. DIMENSIONS MAY VARY 1/2"±.
2. EMERGENCY SHOWER AND EYE WASH STATIONS SHALL BE HAWS MODEL 8336 (OR EQUAL). ALL ASSOCIATED PIPING SHALL BE SCH 80 PVC UNO.
3. MOUNTING PER MANUFACTURER'S RECOMMENDATIONS.
4. PROVIDE 3/4" THICK (NOMINAL) NON-SHRINK NON-METALLIC EPOXY GROUT AS NECESSARY TO PROVIDE LEVEL/ PLUMB INSTALLATION.

EMERGENCY SHOWER AND EYEWASH DETAIL 1
NTS



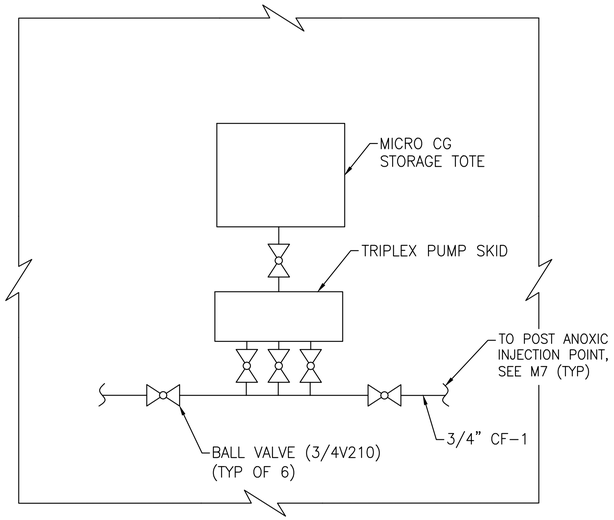
FLG x PE



FLG x FLG

NOTES:
1. COAT WALL PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.
2. DRILL AND TAP FLANGE TO RECEIVE THREADED BOLTS.

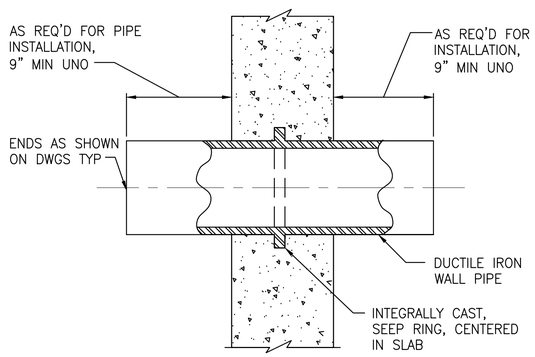
TYPICAL WALL PIPE (FLUSH MOUNTED) DETAIL 2
NTS



PLAN

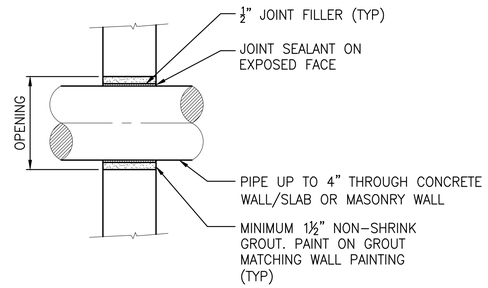
NOTES:
1. SEE SHEET M7 FOR LOCATION.
2. ATTACH TO WALL OF TANK OR WALKWAY W/ PIPE SUPPORT. SEE DETAIL. (2 / M31)
3. CARBON FEED PUMPS (No. 1, 2, 3) SHALL BE ELECTRONIC MECHANICALLY ACTUATED DIAPHRAGM PUMPS AS SPECIFIED IN SPECIFICATION 11290.
4. A 3/4V1196 CONTROL VALVE SHALL BE INSTALLED AT AN ACCESSIBLE LOCATION NEAR THE DISCHARGE POINT FOR EACH TANK.

CARBON FEED PUMP SKID DETAIL 3
NTS



NOTE:
1. COAT WALL PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.

TYPICAL WALL PIPE DETAIL 4
NTS



SMALL DIAMETER PENETRATION DETAIL 5
NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

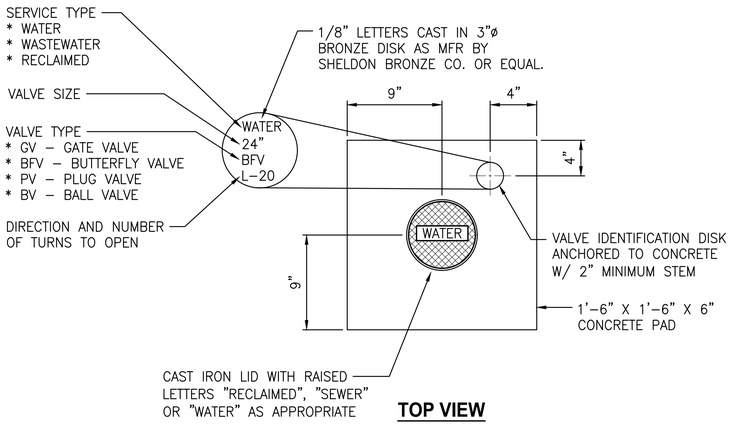
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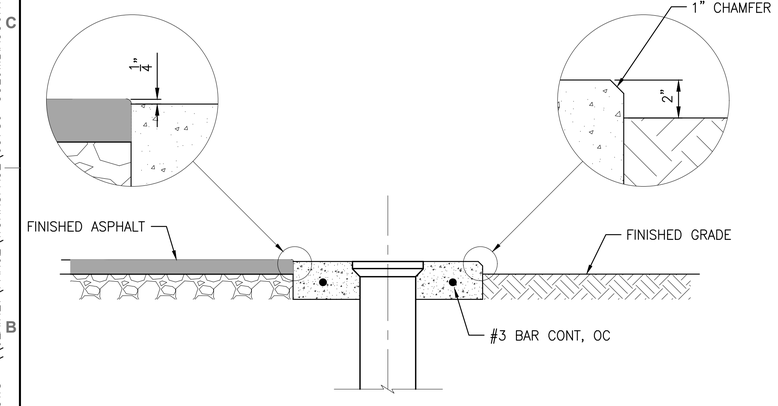
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DATE: APRIL 2022
INDEX NO:
DWG NO: M25

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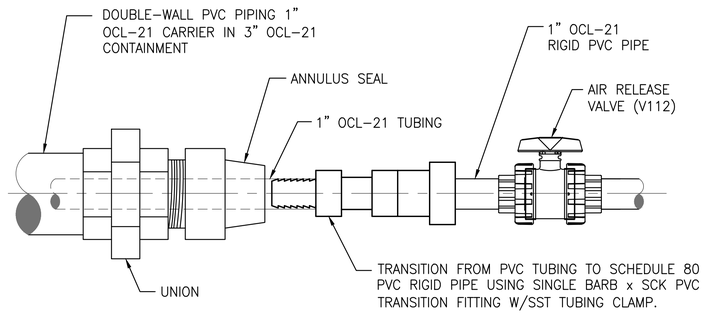


TOP VIEW



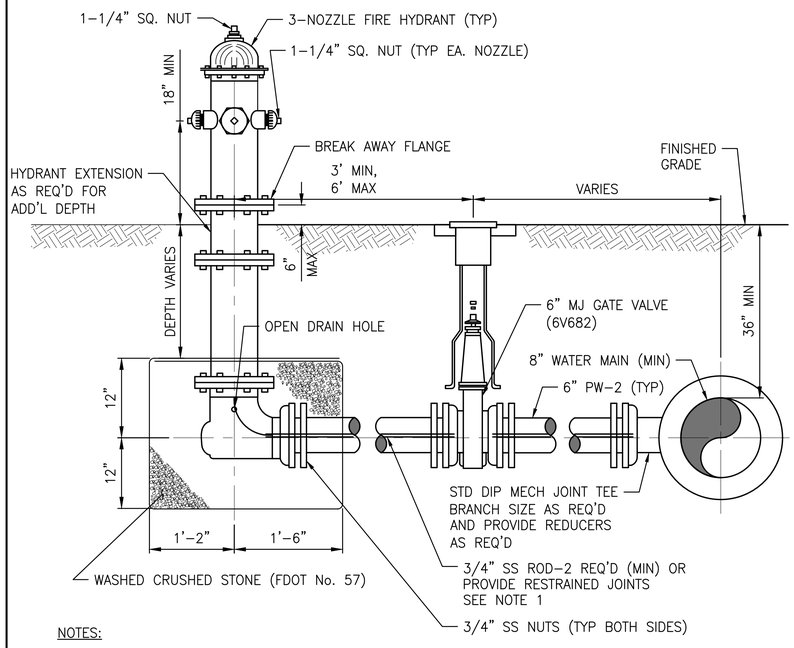
VALVE COLLAR W/ I.D. DISC DETAIL 1

NTS



CHEMICAL INJECTION TRANSITION DETAIL 2

NTS

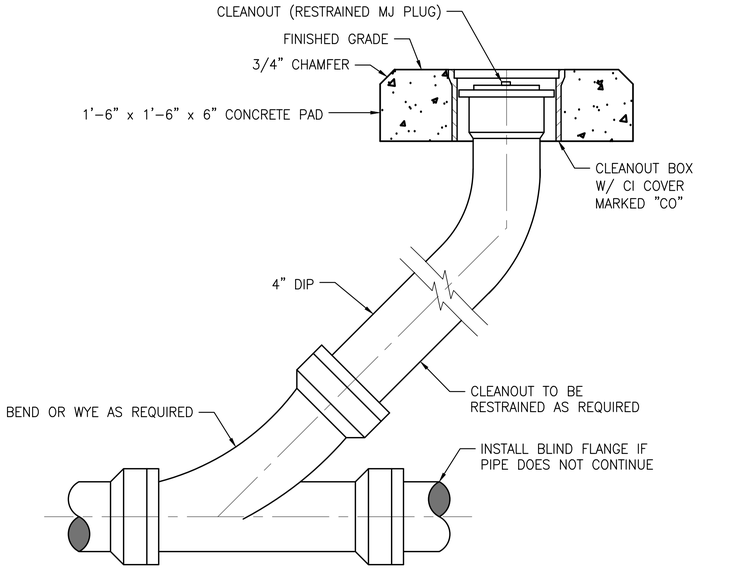


NOTES:

1. 3/4" STAINLESS STEEL ROD CUT AND THREADED AS REQUIRED, OR PROVIDE RESTRAINED JOINTS.
2. FIRE HYDRANTS SHALL BE INSTALLED AS SHOWN ON THE DRAWINGS OR AS DIRECTED IN FIELD.
3. TIE RODS, NUTS, WASHERS AND OTHER FASTENERS SHALL BE TYPE 316 STAINLESS STEEL
4. 4 1/2" PUMPER NOZZLE TO BE PERPENDICULAR TO CENTERLINE OF MAIN.
5. FIRE HYDRANT ASSEMBLY INCLUDES ALL THAT IS SHOWN INCLUDING DI PIPE TO MAIN, DIP TEE AT MAIN, HYDRANT, REDUCERS, VALVE, HYDRANT EXTENSIONS, VALVE EXTENSIONS, ALL PIPING AND MISCELLANEOUS APPURTENANCES REQUIRED FOR A COMPLETE INSTALLATION.

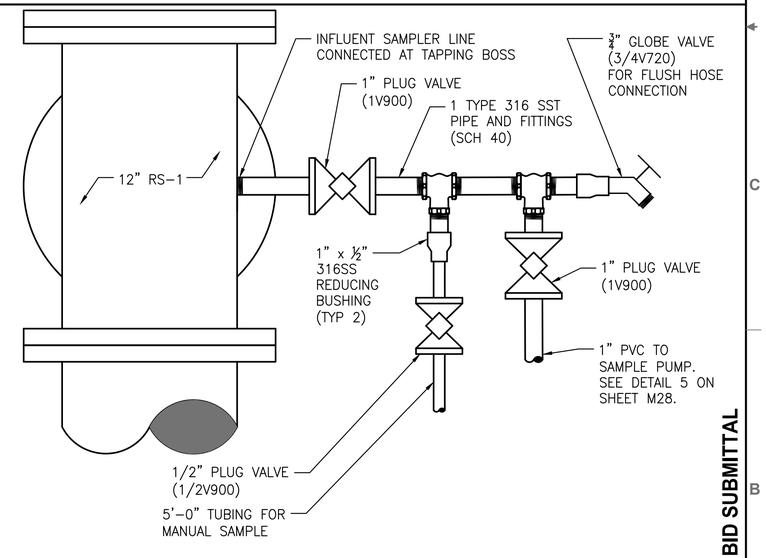
FIRE HYDRANT ASSEMBLY DETAIL 4

NTS



SEWER CLEANOUT DETAIL 3

NTS



INFLUENT SAMPLER PRESSURE FEED ASSEMBLY DETAIL 5

NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

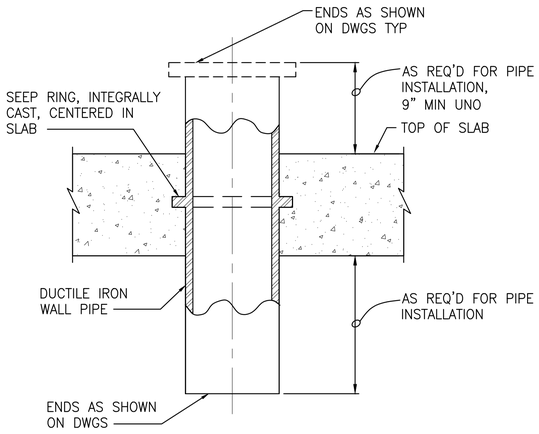
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PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
DWG NO: M26

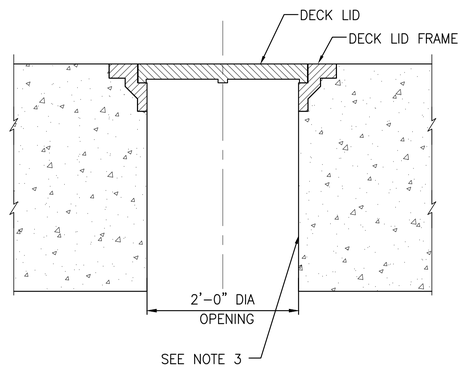
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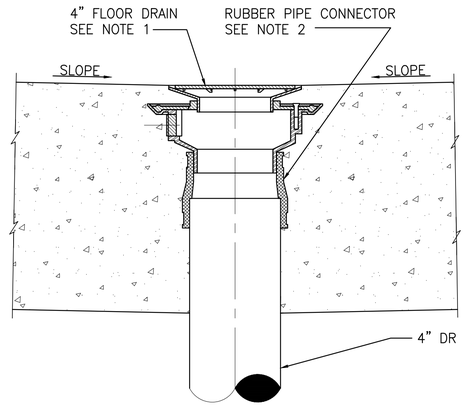
NOTE:
1. COAT FLOOR PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.

TYPICAL FLOOR PIPE DETAIL 1
NTS



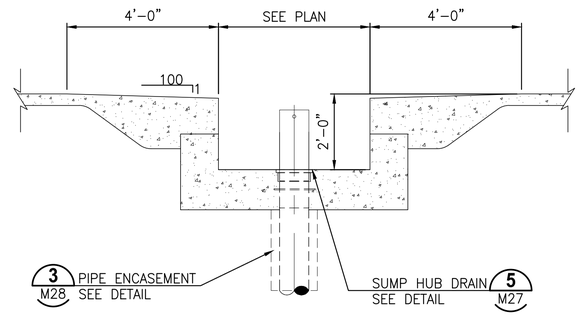
NOTES:
1. DECK LID AND FRAME SHALL BE CATALOG No R–6003 AS FABRICATED BY NEENAH FOUNDRY OR EQUAL.
2. COAT LID AND FRAME WITH SPECIFIED PAINT SYSTEM.
3. COAT CONCRETE SURFACES WITH SPECIFIED PAINT OR LINING SYSTEM.

TYPICAL DECK LID DETAIL 2
NTS

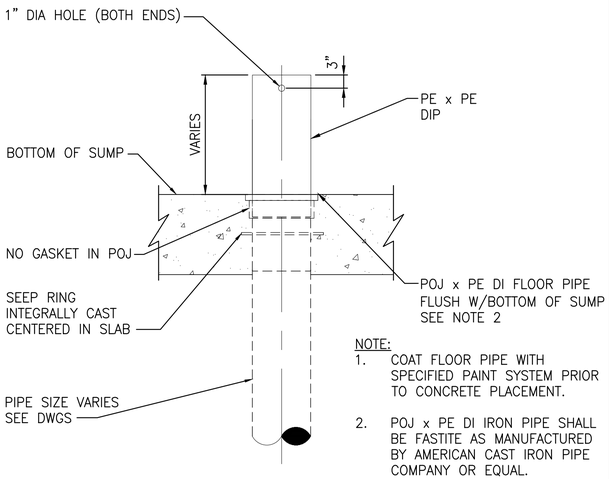


NOTES:
1. FLOOR DRAIN SHALL BE JOSAM MODEL N 30000–SS–Z OR EQUAL WITH EPOXY COATING AND NO–HUB SPIGOT OUTLET.
2. RUBBER PIPE CONNECTOR SHALL B FERNCO, INC. SERIES 1051 OR EQUAL. ALL CLAMPS AND HARDWARE SHALL B AISI TYPE 304SS.

TYPICAL FLOOR DRAIN DETAIL 3
NTS

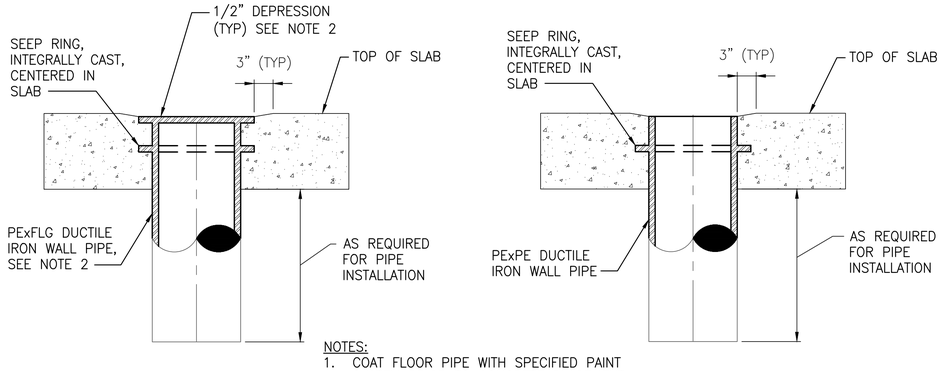


TYPICAL SUMP FLOOR DRAIN DETAIL 4
NTS



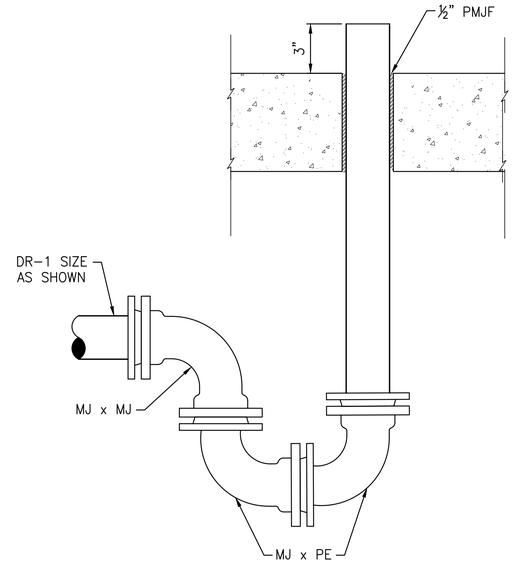
NOTE:
1. COAT FLOOR PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.
2. POJ x PE DI IRON PIPE SHALL BE FASTITE AS MANUFACTURED BY AMERICAN CAST IRON PIPE COMPANY OR EQUAL.

TYPICAL SUMP HUB DRAIN DETAIL 5
NTS



NOTES:
1. COAT FLOOR PIPE WITH SPECIFIED PAINT SYSTEM PRIOR TO CONCRETE PLACEMENT.
2. DRILL AND TAP FLANGE TO RECEIVE THREADED BOLTS.

TYPICAL FLOOR PIPES (FLUSH MOUNTED) DETAIL 6
NTS



HUB DRAIN DETAIL 7
NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

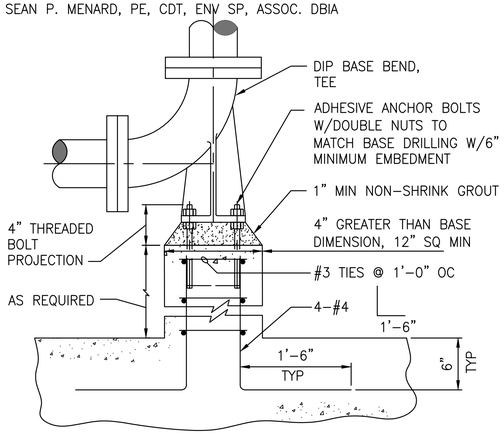
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PROJECT NO: 03780–001–01
DATE: APRIL 2022
INDEX NO:
DWG NO: M27

SAVED: 3/31/2022 4:51 PM JKRAMER \\JEA.NET\PAN02\WORKSPACE\03780–COLUMBIACOUNTY\PROJECTS\001–01 NFMIP WWTF\CAD\DWGS\MECH\03780001–M27.DWG

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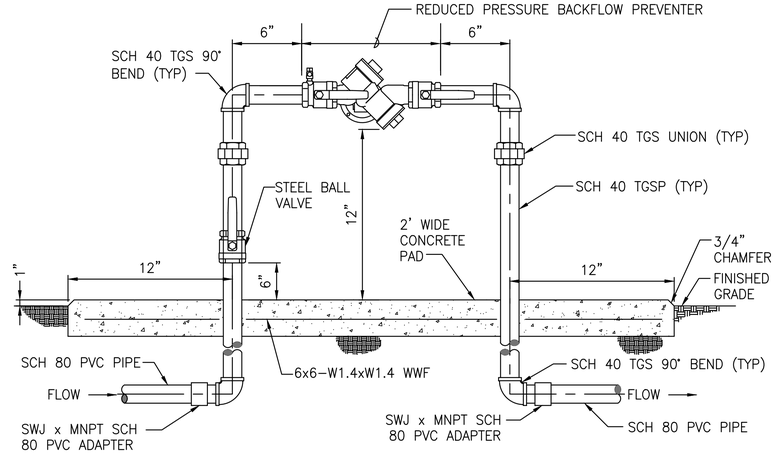


NOTE:
1. ALSO USE FOR SUPPORT OF HORIZONTAL TEE OR CROSS.

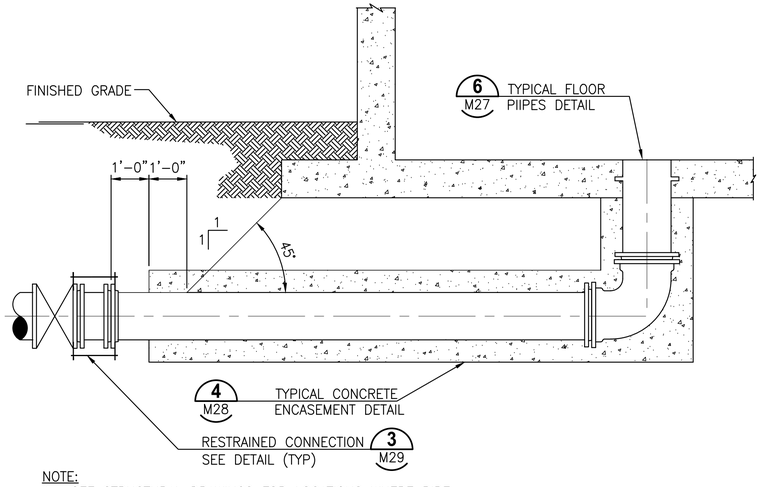
TYPICAL BASE BEND DETAIL 1
NTS

NOTES:

1. SIZE OF METER, ADAPTERS, ETC. SHALL BE THE SAME AS THE SERVICE LINE SHOWN ON THE PLAN.
2. INSULATE ABOVE GRADE PIPING AND BACKFLOW PREVENTER ASSEMBLY.
3. REDUCED PRESSURE BACKFLOW PREVENTER SHALL BE IN ACCORDANCE W/ SPECIFICATION 15145.
4. RESILIENT SEATED BALL VALVES REQUIRED ON ALL BACKFLOW PREVENTION DEVICES 2" AND SMALLER

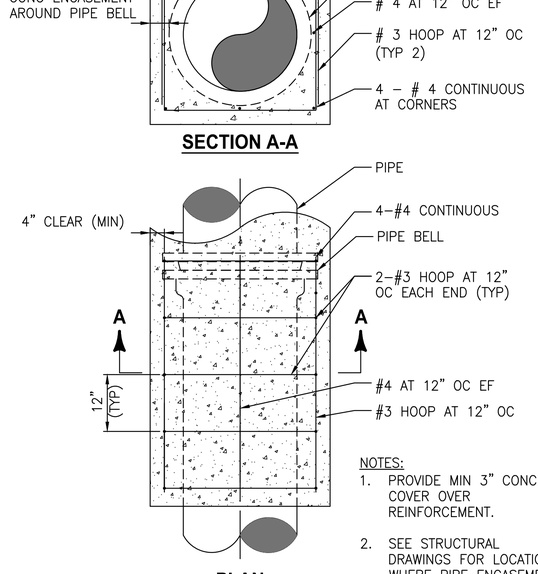


TYPICAL REDUCED PRESSURE BACKFLOW PREVENTER DETAIL 2
NTS



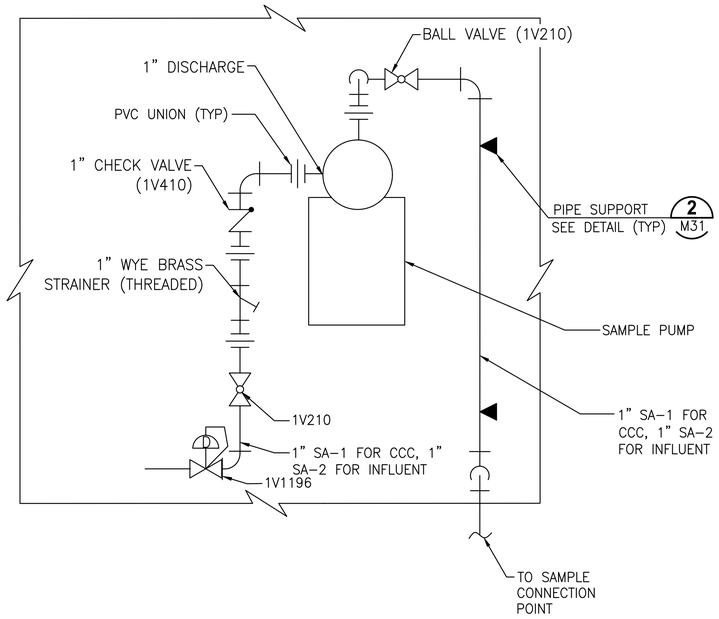
NOTE:
1. SEE STRUCTURAL DRAWINGS FOR LOCATIONS WHERE PIPE ENCASEMENT IS TIED TO THE SLAB.

TYPICAL PIPE ENCASEMENT DETAIL 3
NTS



NOTES:
1. PROVIDE MIN 3" CONC COVER OVER REINFORCEMENT.
2. SEE STRUCTURAL DRAWINGS FOR LOCATIONS WHERE PIPE ENCASEMENT IS TIED TO THE SLAB.

TYPICAL CONCRETE ENCASEMENT DETAIL 4
NTS



NOTES:
1. SEE SHEETS M4 & M11 FOR LOCATIONS.
2. ATTACH TO WALL OR PIPE W/ PIPE SUPPORT. SEE DETAIL. 2 M31
3. SAMPLE PUMPS (No.1, 2, 3, 4) SHALL BE SHALLOW WELL – STAINLESS STEEL, SELF-PRIMING END-SUCTION CENTRIFUGAL JET PUMPS WITH CERAMIC CARBON BELLOWS SEAL.

PLAN

SAMPLE PUMP DETAIL 5
NTS

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LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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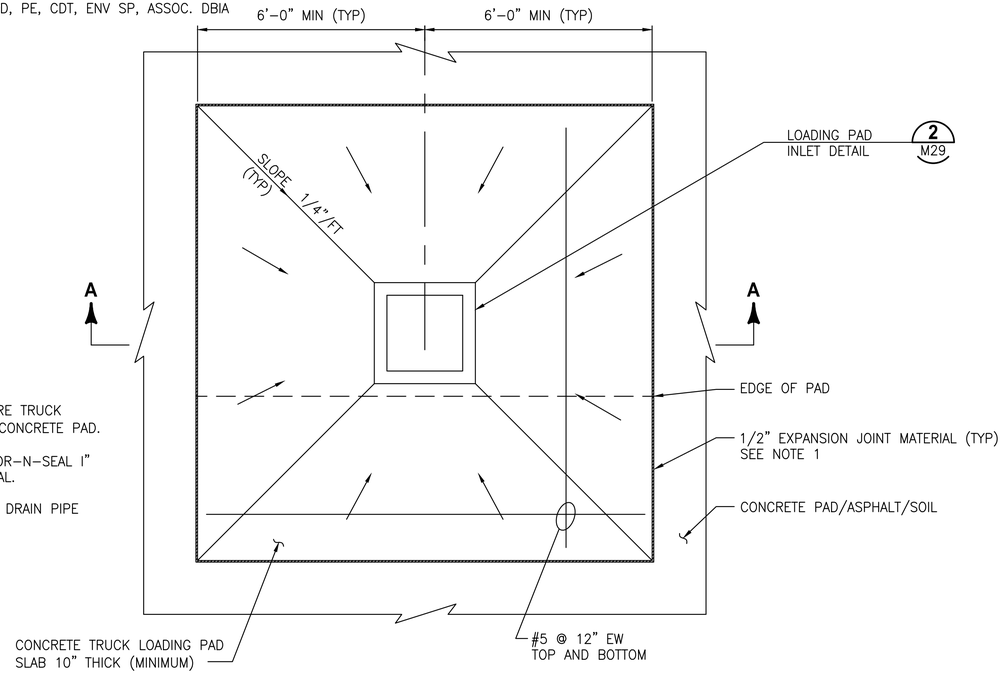
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PLOTTED: 4/11/2022 10:26 AM SEAN P. MENARD, PE, CDT, ENV SP, ASSOC. DBIA

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NOTES:
1. PROVIDE EXPANSION JOINT MATERIAL WHERE TRUCK LOADING PAD ADJOINS AN EXISTING/NEW CONCRETE PAD.
2. MANHOLE PIPE CONNECTOR SHALL BE "KOR-N-SEAL I" AS MANUFACTURED BY NPC, INC OR EQUAL.
3. SEE STRUCTURAL DRAWINGS AND M7 FOR DRAIN PIPE SIZES, INVERTS AND RIM ELEVATIONS.

PLAN

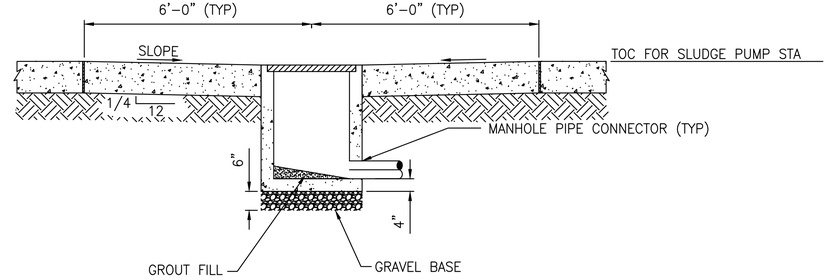
WASHDOWN PAD DETAIL 1

1/2" = 1'-0"

GRAPHIC SCALE

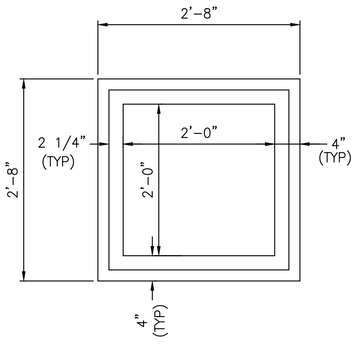
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SCALE IN FEET

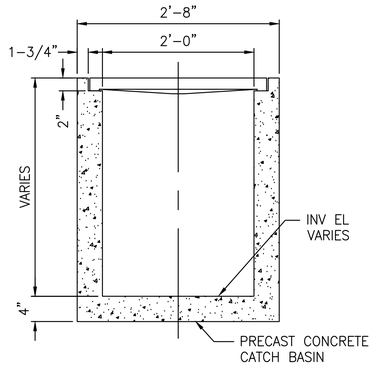


* SEE ELEVATION CALLOUTS ON DRAWINGS

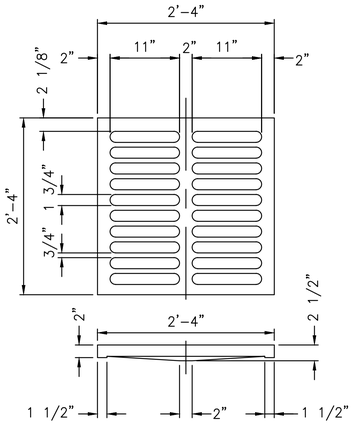
SECTION A-A



PLAN



SECTION



GRATE

LOADING PAD INLET AND PRECAST CONCRETE CATCH BASIN NOTES:
1. GRATE SHALL BE DESIGNED TO H2O LOADING.
2. GRATE SHALL BE CAST IRON.

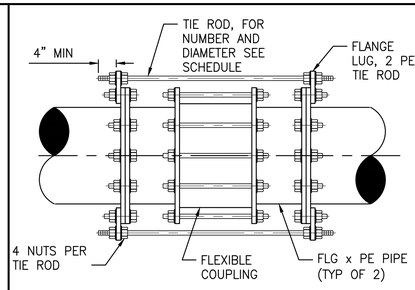
LOADING PAD INLET DETAIL 2

1" = 1'-0"

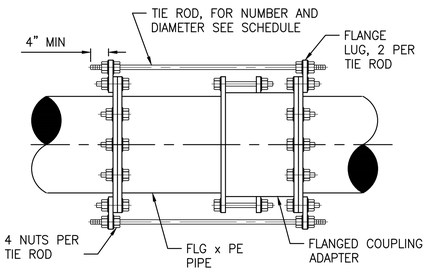
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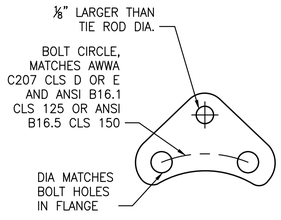
SCALE IN FEET



RESTRAINED FLEXIBLE COUPLING



RESTRAINED FLANGED COUPLING ADAPTER



FLANGE LUG

FLANGE LUG AND TIE ROD SCHEDULE

FIELD TEST PRESSURE		100 PSI	200 PSI	
PIPE DIAMETER (IN)	FLANGE LUG THICKNESS (IN)	NO. OF TIE RODS REQUIRED	NO. OF TIE RODS REQUIRED	TIE ROD DIA (IN)
4	1.0	2	2	0.75
6	1.0	2	2	0.75
8	1.0	2	2	0.75
10	1.0	2	4	0.75
12	1.0	2	4	0.75
14	1.0	2	4	0.75
16	1.0	4	6	0.75
18	1.0	4	8	0.75
20	1.25	4	6	1.0
24	1.25	4	6	1.0
30	1.25	6	10	1.0
36	1.25	8	14	1.0

NOTES:
1. FLANGE LUGS SHALL BE ROMAC INDUSTRIES, INC. STYLE 494, OR APPROVED EQUAL.
2. TIE RODS AND FLANGE LUGS SHALL BE ASTM A193B8M AISI TYPE 316 SST, UNLESS NOTED OTHERWISE.
3. TIE ROD NUTS SHALL BE ASTM A194B8M AISI TYPE 316 SST.
4. INSTALL SIZES AND NUMBERS OF FLANGE LUGS AND TIE RODS SHOWN IN THE SCHEDULE FOR PIPE WITH FIELD TEST PRESSURES NOT TO EXCEED 100 PSIG AND 200 PSIG.
5. INSTALL TIE RODS EQUALLY SPACED AROUND PIPE.
6. TIGHTEN TIE RODS IN EQUAL STAGES TO PROVIDE EVEN ALIGNMENT OF CONNECTING PIPE AND COUPLING. TIGHTEN TIE RODS EQUALLY TO EQUALLY DISTRIBUTE PRESSURE LOAD TO EACH TIE ROD.
7. COAT ALL FERROUS METAL SURFACES (EXCEPT STAINLESS STEELS) IN ACCORDANCE WITH PAINTING AND COATING SPECIFICATIONS.

TYPICAL RESTRAINED CONNECTION DETAILS 3

NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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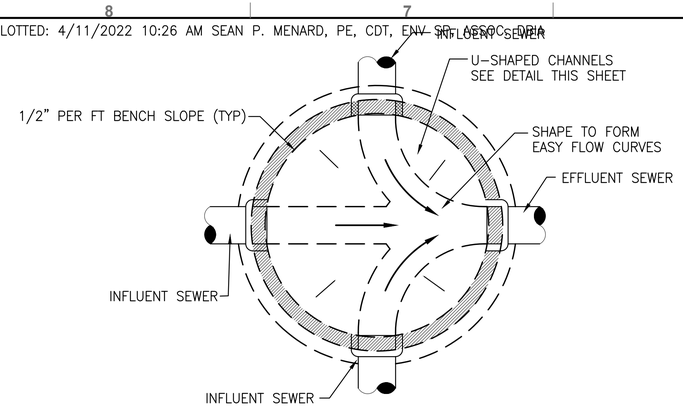
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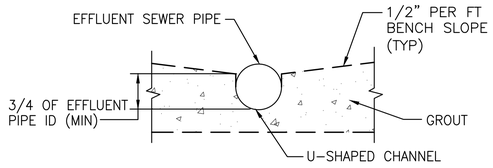
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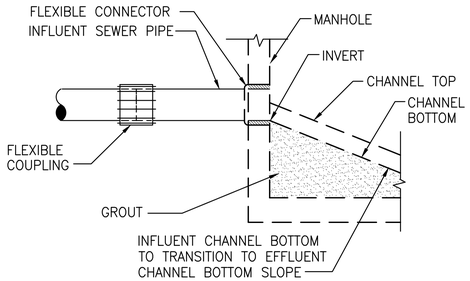


PLAN



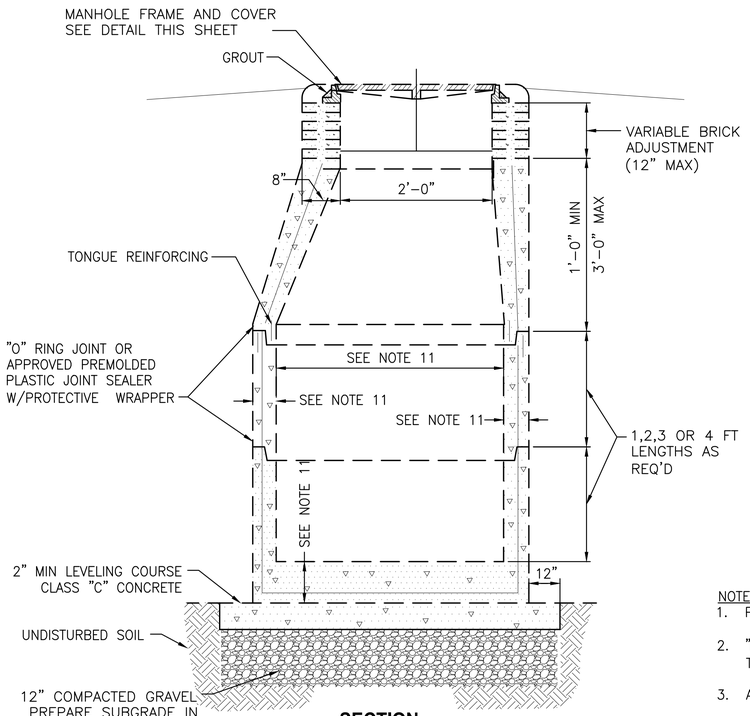
TYPICAL U-SHAPED CHANNEL

NTS



TYPICAL INFLUENT GRAVITY SEWER CONNECTION TO MANHOLE

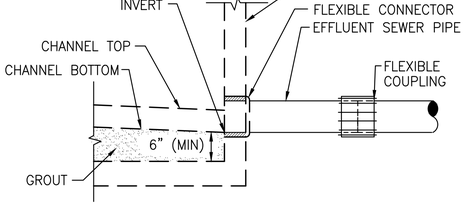
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SECTION

MANHOLE DETAIL 1

NTS

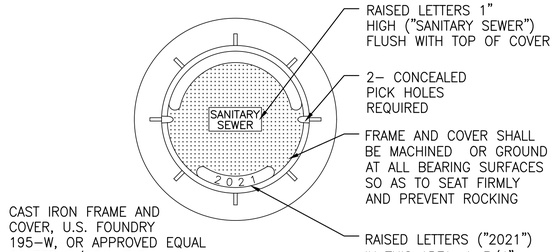


TYPICAL EFFLUENT GRAVITY SEWER CONNECTION TO MANHOLE

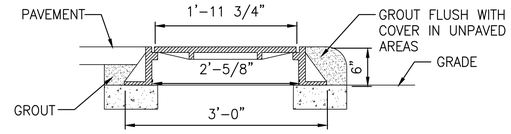
NTS

NOTES:

1. PRECAST CONCRETE TYPE II 4000 P.S.I.
2. "RAMNEK" OR EQUAL AT ALL RISER JOINTS (1/2" THICK WITH WIDTH AT LEAST 1/2 THE WALL THICKNESS) WITH GROUT INSIDE AND OUTSIDE.
3. ALL OPENINGS SHALL BE SEALED WITH A WATERPROOF NON-SHRINKING GROUT.
4. FLOW CHANNELS SHALL BE CONSTRUCTED TO DIRECT INFLUENT INTO FLOW STREAM (SEE DETAIL).
5. LIFT HOLES ARE PERMITTED AND SHALL BE SEALED AFTER PLACEMENT OF RISER.
6. ALL PIPE HOLES SHALL BE PRECAST OR CORE-DRILLED.
7. APPROVED RUBBER BOOT MUST BE USED WITH PVC PIPE.
8. INSIDE DROPS SHALL NOT EXCEED 2.0 FEET.
9. CONNECTIONS AND GROUTING IN MANHOLE NOT SHOWN. SEE DRAWINGS FOR PIPE SIZES, LOCATIONS AND INVERTS, FOR DETAILS REGARDING SEWER PIPE CONNECTIONS TO MANHOLE, SEE TYPICAL INFLUENT AND EFFLUENT DETAILS.
10. 5'x5'x6" CONCRETE COLLAR IS REQUIRED WHEN MANHOLE IS OUT OF PAVEMENT.
11. AS REQUIRED BY POLYMER CONCRETE MANUFACTURER.



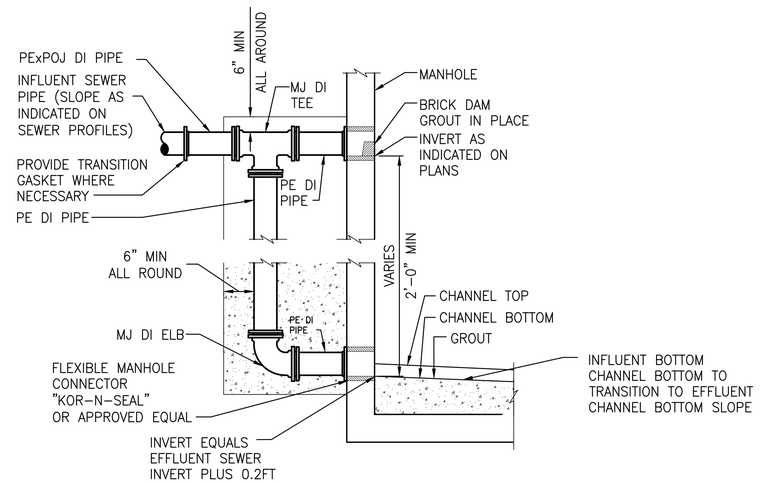
PLAN



SECTION

MANHOLE FRAME AND COVER DETAIL 2

NTS



DROP MANHOLE DETAIL 3

NTS

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LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

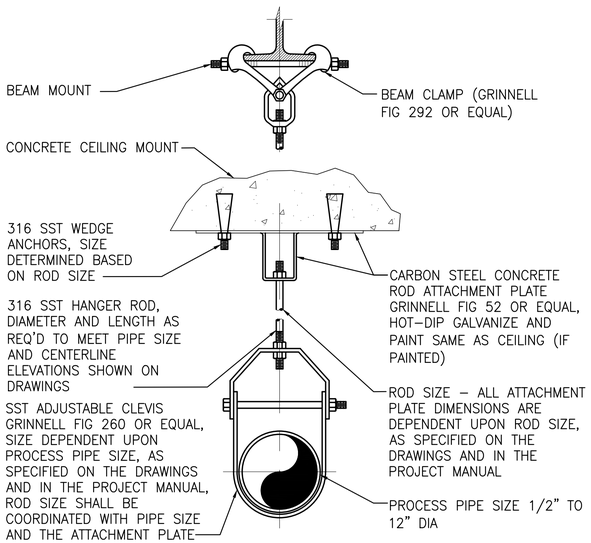
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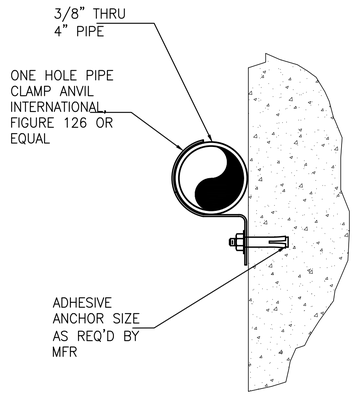
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TYPICAL PIPE SUPPORT HANGER CLEVIS & PL DETAIL 1

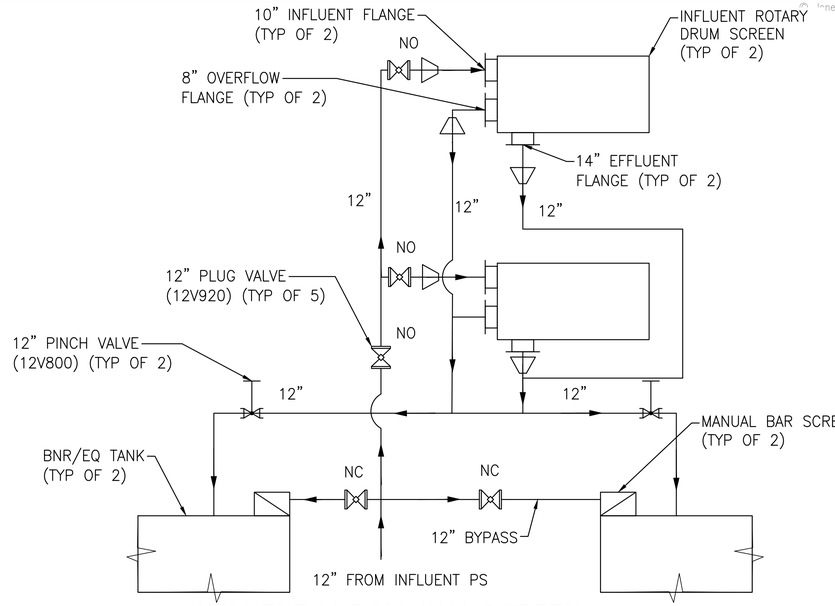
NTS



NOTES:
1. SPACE PIPE SUPPORTS TO SUIT LOAD.
2. CLAMP SHALL SS UNO.

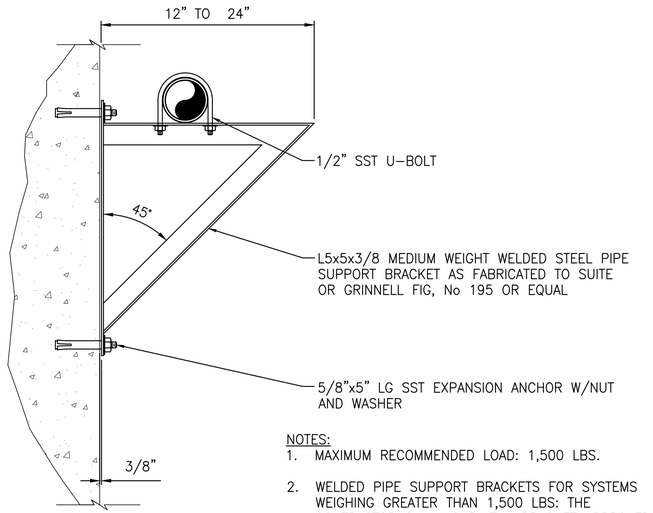
TYPICAL PIPE SUPPORT WALL CLAMP DETAIL 2

NTS



INFLUENT AND MANUAL SCREEN PIPING AND VALVE SCHEMATIC 3

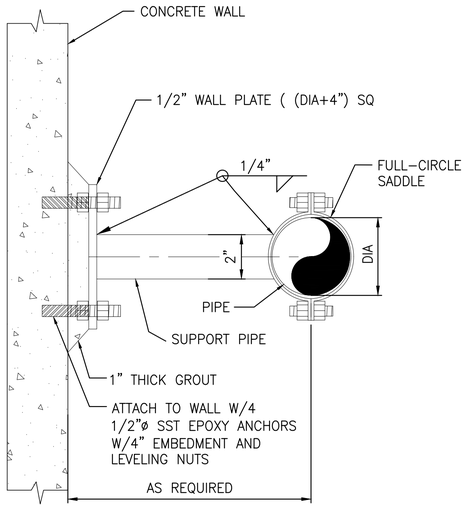
CONFIRM THESE DETAILS ARE NEEDED



NOTES:
1. MAXIMUM RECOMMENDED LOAD: 1,500 LBS.
2. WELDED PIPE SUPPORT BRACKETS FOR SYSTEMS WEIGHING GREATER THAN 1,500 LBS: THE CONTRACTOR SHALL SUBMIT A BRACKET APPROVED BY A STRUCTURAL ENGINEER TO JONES EDMUNDS FOR REVIEW AS PER SHOP DRAWING SUBMITTAL PROCEDURES IN THE SPECIFICATIONS.

TYPICAL PIPE SUPPORT WELDED STEEL DETAIL 4

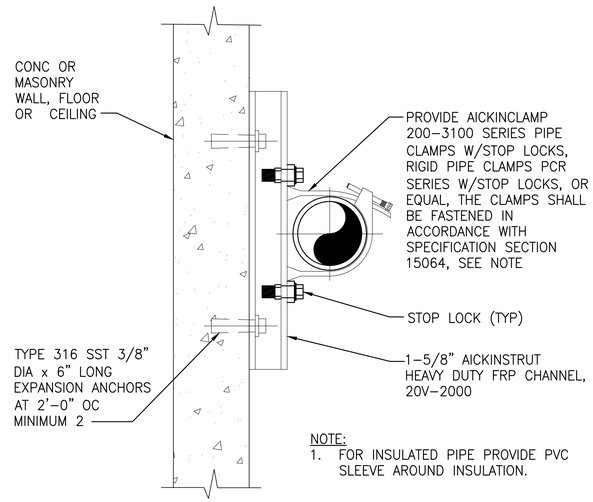
NTS



NOTES:
1. ALL HARDWARE, PLATE, SADDLE, ETC, SHALL BE 300 SERIES SST.
2. SUPPORT PIPE SHALL BE 316 SS.

TYPICAL WALL MOUNTED PIPE SUPPORT (TOP VIEW) DETAIL 5

NTS



NOTE:
1. FOR INSULATED PIPE PROVIDE PVC SLEEVE AROUND INSULATION.

CONCRETE SLABS, WALLS, AND CEILINGS

TYPICAL NONMETALLIC PIPE SUPPORT DETAIL 6

NTS

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DRAWN JKRAMER
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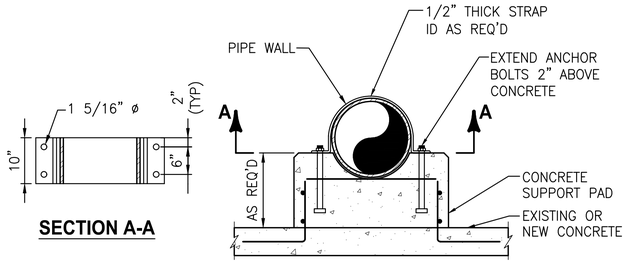
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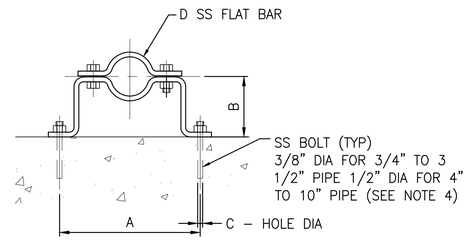
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TYPICAL CONCRETE PIPE SUPPORT DETAIL 1

NTS

NOT USED 2



PIPE SIZE	A	B	C	D FLAT BAR SIZE	LOAD RATING LBS *
3/4	5 15/16	2 1/2	7/16	3/16 x 1 1/4	190
1	6 1/4	2 5/8	7/16	3/16 x 1 1/4	–
1 1/4	6 11/16	2 3/4	7/16	3/16 x 1 1/4	–
1 1/2	6 15/16	3	7/16	3/16 x 1 1/4	190
2	8 5/16	3 3/16	7/16	1/4 x 1 1/4	420
2 1/2	8 7/8	3 7/16	7/16	1/4 x 1 1/4	–
3	9 1/8	3 3/4	7/16	1/4 x 1 1/4	420
3 1/2	10 1/16	4	7/16	1/4 x 1 1/4	610
4	10 9/16	4 1/4	9/16	1/4 x 1 1/4	–
5	11 3/4	4 3/4	9/16	1/4 x 1 1/4	610
6	14 3/8	5 5/16	9/16	3/8 X 1 1/2	870
8	16 5/8	6 5/16	9/16	3/8 X 1 1/2	870

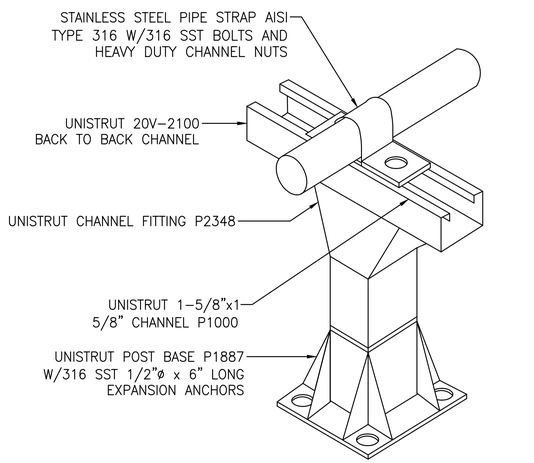
* SAFETY FACTOR OF 5

NOTES:

1. WHEN USED WITH PVC PIPE, PROVIDE 18 GA PAINTED SHEET STEEL SLEEVE 6" LONG W/STAINLESS STEEL HOSE CLAMPS AROUND PIPE AT CLAMP WITH LOOSE FIT. WRAP COPPER TUBES W/2" STRIP OF RUBBER FABRIC.
2. FOR FLANGED PIPING INCREASE B DIMENSION A REQUIRED.
3. PAINT PIPE SUPPORT SAME AS PIPE.
4. USE ADHESIVE ANCHORS FOR MOUNTING ON CONCRETE.
5. ALL MOUNTING HARDWARE SHALL BE AISI THDE 304 UNO.
6. PIPE SUPPORT SHALL BE BY ANVIL FIGURE NO. 103 OFFSET PIPE CLAMP OR EQUAL.

TYPICAL PIPE SUPPORT DETAIL 3

NTS

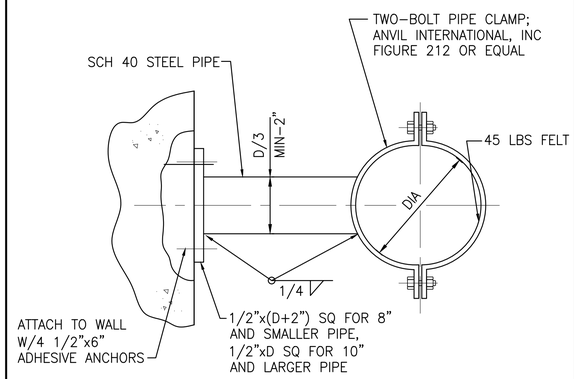


NOTE:

1. ALL CHANNELS AND FITTINGS SHALL BE DIPPED GALVANIZED STEEL UNO.

TYPICAL CHANNEL STRUT PIPE SUPPORT DETAIL 4

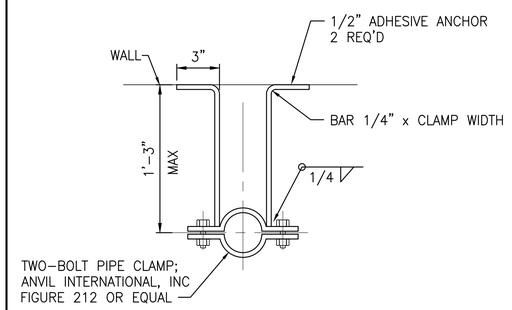
NTS



PLAN

TYPICAL SWAY BRACE (TYPE A) DETAIL 5

NTS



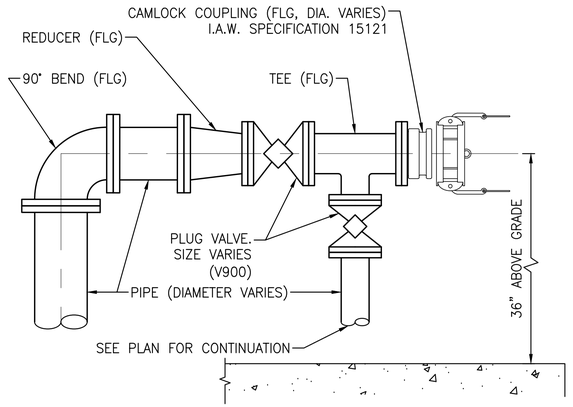
PLAN

NOTES:

1. SPACE SUPPORTS TO SUIT LOADS.
2. WHEN INSTALLED INSIDE WATER HOLDING BASINS, FABRICATE ENTIRE SWAY BRACE FROM AISI TYPE 304L STAINLESS STEEL COMPONENTS.

TYPICAL SWAY BRACE (TYPE B) DETAIL 6

NTS



CAMLOCK COUPLING (ABOVE GRADE) DETAIL (TYP) 7

NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

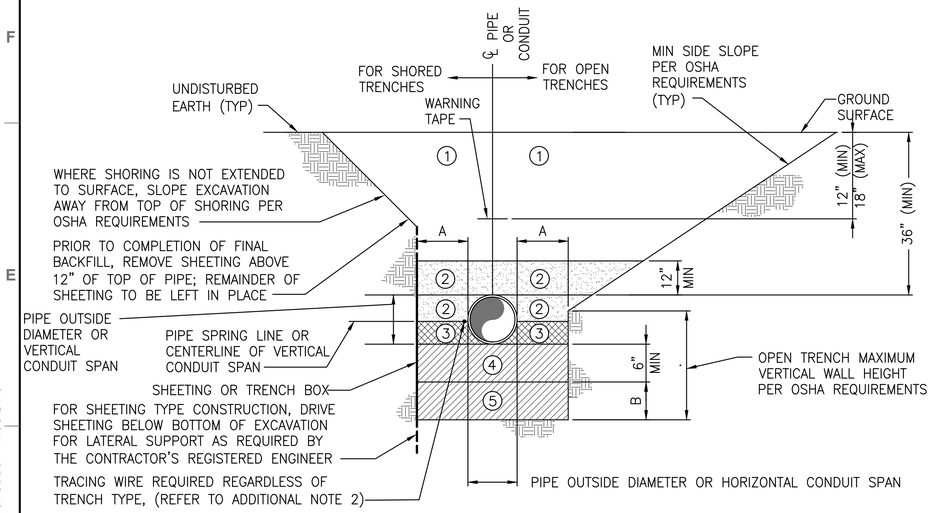
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PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO: M32

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NOMINAL PIPE DIAMETER OR HORIZONTAL CONDUIT SPAN (INCHES)	MINIMUM SIDEWALL CLEARANCE	ADDITIONAL EXCAVATION DEPTH (1)
	A (INCHES)	B (INCHES)
LESS THAN 24	12	12
24 AND GREATER	18	18

(1) REQUIRED WHERE UNSUITABLE MATERIAL IS ENCOUNTERED.

ZONE NO.	ZONE NAME	MATERIAL	ZONE 1 COMPACTION	ZONES 2–5 COMPACTION
(1)	FINAL BACKFILL	AS SPECIFIED	AT LEAST 98% MODIFIED PROCTOR MAXIMUM DRY DENSITY ASTM D–1557	AT LEAST 95% MODIFIED PROCTOR MAXIMUM DRY DENSITY ASTM D–1557
(2)	INITIAL BACKFILL			
(3)	HAUNCHING			
(4)	BEDDING			
(5)	FOUNDATION			

TRENCH ZONE NOTES:

(1) FINAL BACKFILL SHALL BE INSTALLED IN LIFTS NOT EXCEEDING 6 INCHES, LOOSE MEASUREMENT. REFER TO ADDITIONAL NOTE 3.

(2) INITIAL BACKFILL SHALL BE INSTALLED IN LIFTS NOT EXCEEDING 6 INCHES, LOOSE MEASUREMENT. ALL LIFTS SHALL BE COMPACTED BY HAND TAMPING OR AN APPROVED METHOD OF MECHANICAL TAMPING. REFER TO ADDITIONAL NOTE 3.

(3) HAUNCHING SHALL BE IN COMPLETELY DEWATERED TRENCHES IN LIFTS NOT EXCEEDING 6 INCHES, LOOSE MEASUREMENT. ALL LIFTS SHALL BE COMPACTED BY HAND TAMPING. HAUNCHING SHALL BE BROUGHT UP EQUALLY ON BOTH SIDES OF THE PIPE.

(4) BEDDING SHALL BE INSTALLED IN COMPLETELY DEWATERED TRENCHES IN LIFTS NOT EXCEEDING 6 INCHES, LOOSE MEASUREMENT, AND SHALL BE COMPACTED BY HAND OR MECHANICAL TAMPING. PROPERLY SHAPED BELL HOLES SHALL BE EXCAVATED IN THE BEDDING TO PERMIT ASSEMBLY OF THE PIPE. REFER TO ADDITIONAL NOTE 3.

NATIVE, UNDISTURBED MATERIAL IN COMPLETELY DEWATERED TRENCHES MEETING THE COMPACTION AND MATERIAL REQUIREMENTS FOR COMPACTED BEDDING MATERIAL NEED NOT BE REPLACED OR REWORKED, EXCEPT FOR SHAPING OF THE BELL HOLES, AND WHERE REFILL IS REQUIRED.

(5) FOUNDATION SHALL BE REQUIRED WHERE UNSUITABLE MATERIAL IS ENCOUNTERED. FOUNDATION SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS FOR BEDDING. REFER TO ADDITIONAL NOTE 3.

ADDITIONAL NOTES:

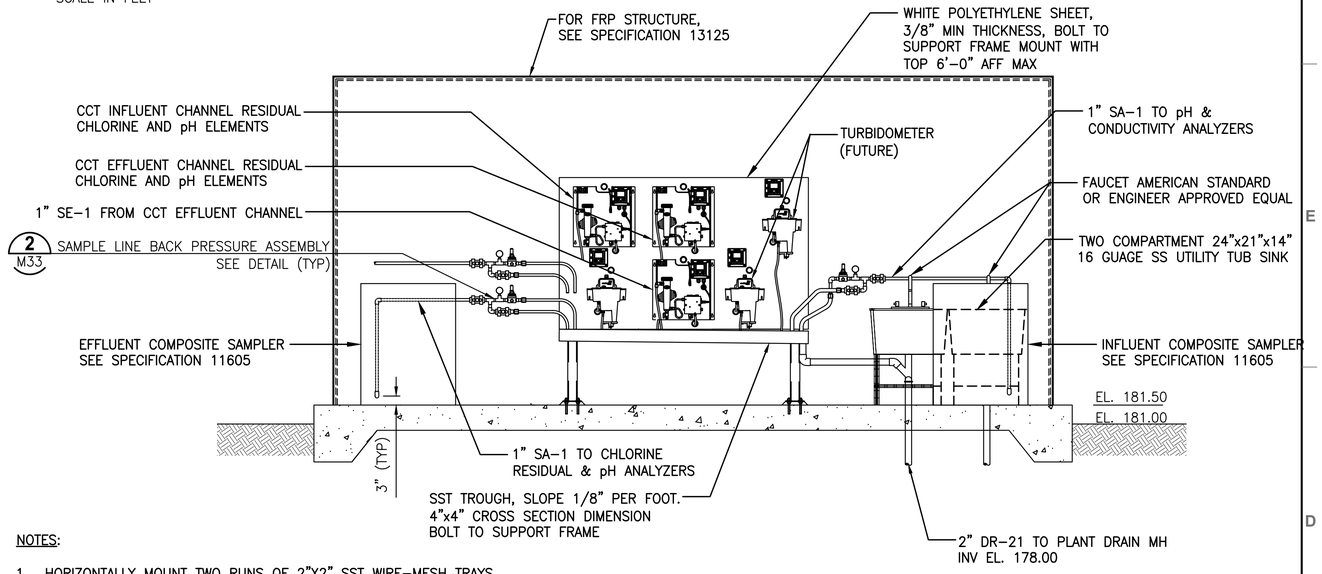
1. FOR TRENCHES IN VEHICULAR TRAFFIC AREAS OR BENEATH SURFACE IMPROVEMENTS (EG, SLAB, ETC.) SEE CONTRACT SPECIFICATIONS FOR ADDITIONAL COMPACTION REQUIREMENTS. SEE CIVIL DRAWINGS FOR ASPHALT RESTORATION DETAILS.
2. TRACING WIRE SHALL BE INSTALLED ON THE SIDE OF THE PIPE AND ATTACHED TO THE PIPE EVERY 10' W/ A NYLON WIRE TIE. IF THE WIRE IS DAMAGED OR NEEDS TO BE EXTENDED A 3M WATERPROOF TYPE UF SPLICE SHALL BE INSTALLED TO REPAIR THE WIRE. THE ENDS OF THE TRACING WIRE SHALL BE BROUGHT UP IN EVERY VALVE BOX ON THE LINE AND AT THE HYDRANT VALVES. THERE SHALL BE A MINIMUM COIL OF 3' LEFT UNDER THE VALVE BOX COVER. THE WIRE SHALL BE TESTED TO VERIFY CONDUCTIVITY.
3. ALTERNATIVE LIFT THICKNESSES, NOT EXCEEDING 12 INCHES LOOSE MEASUREMENT, ARE ACCEPTABLE IN TRENCH ZONES 1, 2, 4, AND 5 PROVIDED 1) THE LIFT THICKNESS DOES NOT EXCEED THE MAXIMUM VALUE RECOMMENDED IN WRITING BY THE APPLICABLE PIPE MANUFACTURER AND 2) FIELD TEST RESULTS CONFIRM THAT THE SPECIFIED COMPACTION REQUIREMENTS ARE BEING MET.

TYPICAL UTILITY TRENCH DETAIL 3
NTS

GRAPHIC SCALE

0 1 2 4

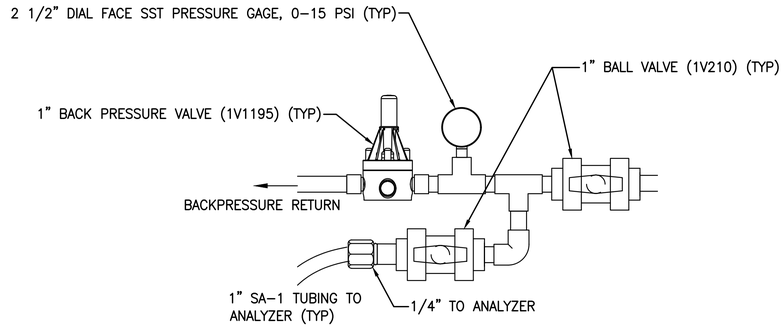
SCALE IN FEET



NOTES:

1. HORIZONTALLY MOUNT TWO RUNS OF 2"X2" SST WIRE–MESH TRAYS ACROSS THE BACK OF THE PANEL TO SUPPORT THE SAMPLE TUBING. MOUNT THE LOWER TRAY AT THE BOTTOM EDGE OF THE PANEL AND MOUNT THE UPPER TRAY AT MID–SPAN.

FRP ANALYZER STRUCTURE 1
1/2" = 1'–0"



NOTES:

1. EACH SAMPLE LINE REQUIRES A BACK PRESSURE ASSEMBLY. VERIFICATION AND/OR COORDINATION BY CONTRACTOR IS REQUIRED WITH RESPECT TO APPROVED SHOP DRAWING PRIOR TO CONSTRUCTION.
2. (2) 1" SA–1 (RETURN) AND (2) 1" SA–1 (RETURN) PIPES NOT SHOWN FOR CLARITY. CONTRACTOR SHALL ROUTE PIPES ALONG SAME ALIGNMENT AS SUPPLY PIPES.

SAMPLE LINE BACK PRESSURE ASSEMBLY 2
NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

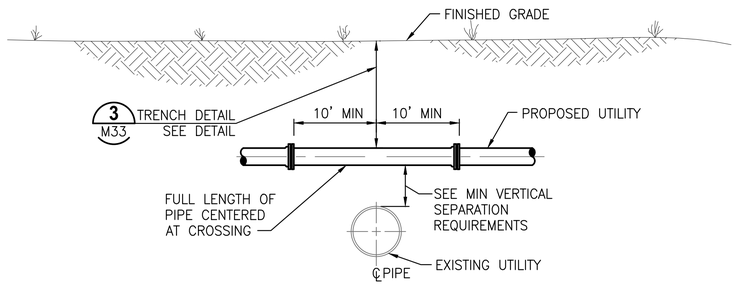
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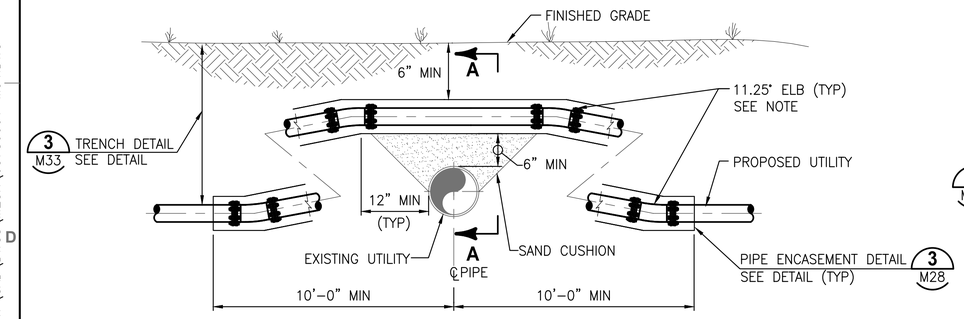
PROJECT NO: 03780–001–01
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INDEX NO:
DWG NO: M33

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OPTION 1 (SUFFICIENT COVER AND SEPARATION AVAILABLE)



NOTE:
IF SUFFICIENT COVER IS NOT AVAILABLE, PROVIDE FITTINGS AS SHOWN.

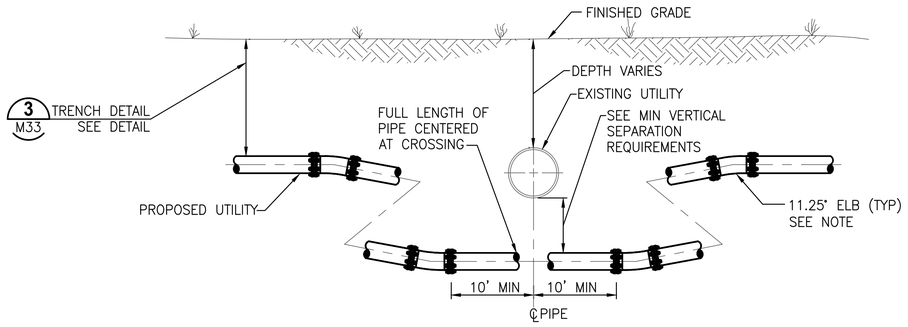
ALTERNATE OPTION 1 (SUFFICIENT COVER OR SEPARATION NOT AVAILABLE)

PROPOSED UTILITY	EXISTING UTILITY						
	POTABLE WATER	GRAVITY SANITARY SEWER	SEWAGE FORCE MAIN	STORM	RECLAIMED WATER	ELECTRIC TELECOMMUNICATIONS	COMMENTS
POTABLE WATER	1'–0"	1'–6"	1'–6"	1'–0"	1'–6"	1'–0"	SEE NOTE 1
GRAVITY SANITARY SEWER	1'–6"	1'–0"	1'–0"	1'–6"	1'–6"	1'–0"	
SEWAGE FORCE MAIN	1'–6"	1'–0"	1'–0"	1'–6"	1'–6"	1'–0"	SEE NOTE 2
STORM	1'–0"	1'–6"	1'–6"	1'–0"	1'–0"	1'–0"	
RECLAIMED WATER	1'–6"	1'–6"	1'–6"	1'–0"	1'–0"	1'–0"	SEE NOTE 2
ELECTRIC TELECOMMUNICATIONS	1'–0"	1'–0"	1'–0"	1'–0"	1'–0"	1'–0"	

NOTES:
1. ONLY OPTION 1 CONSTRUCTION IS ALLOWED WITHOUT APPROVAL OF ENGINEER.
2. ONLY OPTION 2 CONSTRUCTION IS ALLOWED WITHOUT APPROVAL OF ENGINEER.
3. FITTINGS SHALL NOT BE USED ON GRAVITY SANITARY SEWER. GRAVITY SANITARY SEWER SHALL BE CONSTRUCTED AT A UNIFORM GRADE BETWEEN MANHOLE STRUCTURES

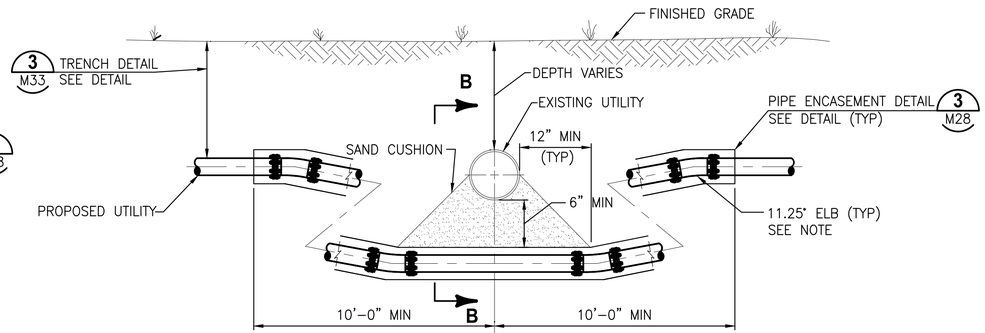
MINIMUM VERTICAL SEPARATION REQUIREMENTS

TYPICAL UTILITY CONFLICT DETAIL 1
NTS



NOTE:
IF ADDITIONAL COVER BEYOND MIN IS REQUIRED TO INSTALL PROPOSED UTILITY BENEATH EXISTING UTILITY, PROVIDE FITTINGS AS SHOWN.

OPTION 2 (SUFFICIENT SEPARATION AVAILABLE)



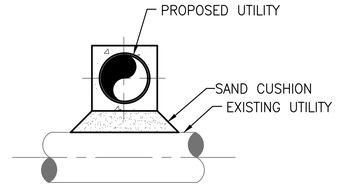
NOTE:
IF ADDITIONAL COVER BEYOND MIN IS REQUIRED TO INSTALL PROPOSED UTILITY BENEATH EXISTING UTILITY, PROVIDE FITTINGS AS SHOWN.

ALTERNATE OPTION 2 (SUFFICIENT SEPARATION NOT AVAILABLE)

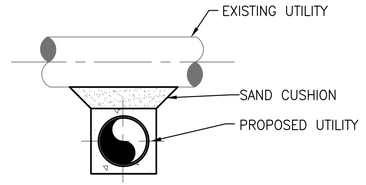
PROPOSED UTILITY	EXISTING UTILITY						
	POTABLE WATER	GRAVITY SANITARY SEWER	SEWAGE FORCE MAIN	STORM	RECLAIMED WATER	ELECTRIC TELECOMMUNICATIONS	TREE
POTABLE WATER	1'–0"	10'–0"	10'–0"	3'–0"	3'–0"	3'–0"	10'–0"
GRAVITY SANITARY SEWER	10'–0"	1'–0"	1'–0"	5'–0"	5'–0"	3'–0"	
SEWAGE FORCE MAIN	10'–0"	1'–0"	1'–0"	3'–0"	3'–0"	3'–0"	
STORM	3'–0"	5'–0"	3'–0"	1'–0"	3'–0"	3'–0"	
RECLAIMED WATER	3'–0"	5'–0"	3'–0"	3'–0"	1'–0"	3'–0"	
ELECTRIC TELECOMMUNICATIONS	3'–0"	3'–0"	3'–0"	3'–0"	3'–0"	2'–0"	

MINIMUM HORIZONTAL SEPARATION REQUIREMENTS

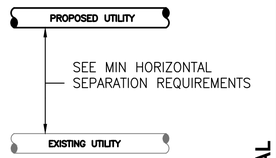
TYPICAL UTILITY HORIZONTAL SEPARATION DETAIL 2
NTS



SECTION A-A



SECTION B-B



PLAN VIEW

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DRAWN JKRAMER
CHECKED SMENARD

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WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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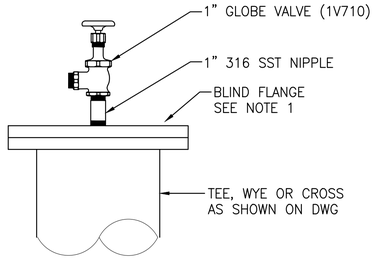
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INDEX NO:
DWG NO: M34

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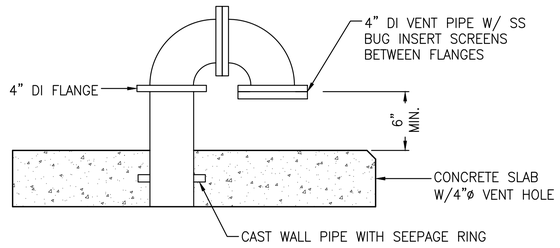
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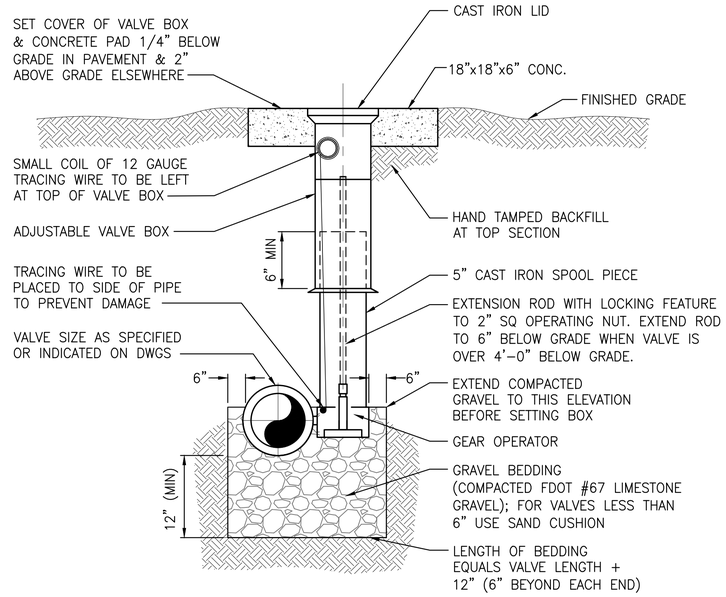
NOTE:

1. DRILL AND TAP FLANGE FOR 1 1/2" NPT NIPPLE.

TYPICAL HOSE CONNECTION DETAIL 1
NTS

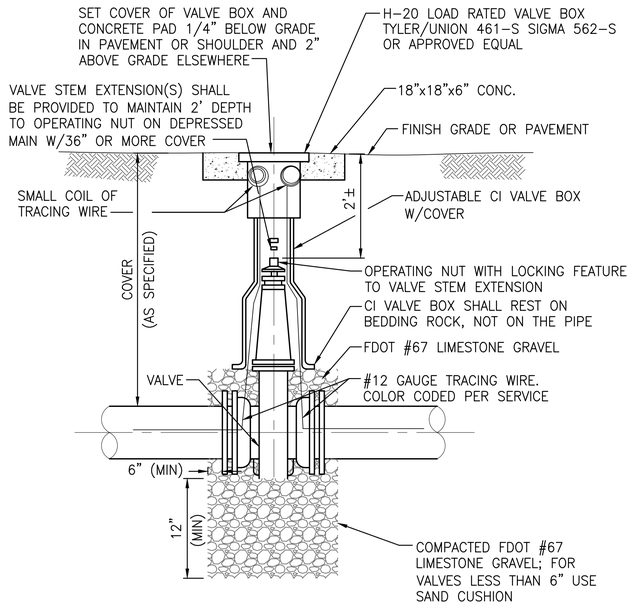


WET WELL VENT DETAIL 2
NTS



TYPICAL BUTTERFLY OR PLUG VALVE DETAIL 3
NTS

NOT USED 4



TYPICAL GATE VALVE AND BOX DETAIL 5
NTS

NOT USED 6

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DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
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COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

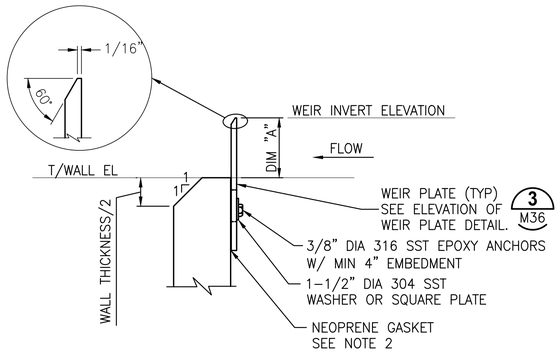
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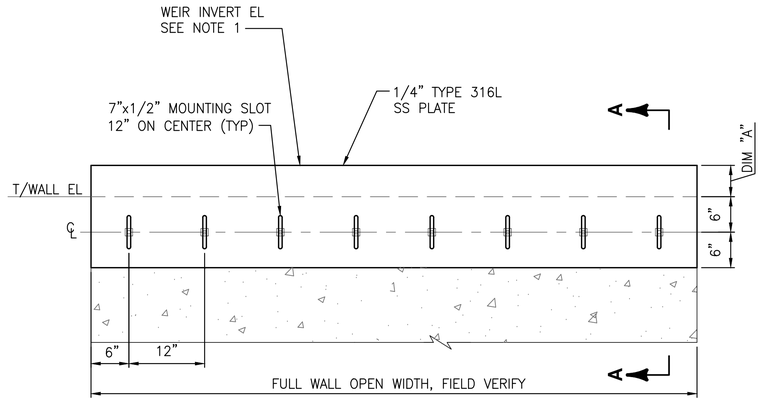
SECTION A-A

NOTES:

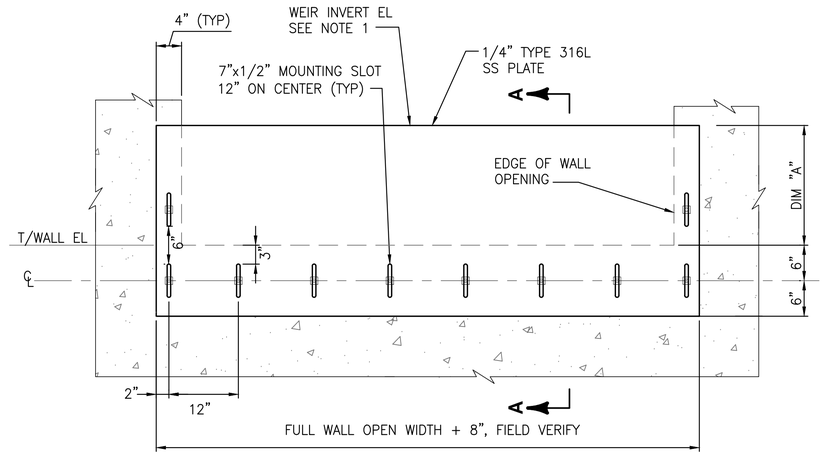
1. DIM "A" REQUIRES VERIFICATION AND/OR COORDINATION BY CONTRACTOR WITH RESPECT TO APPROVED SHOP DRAWING PRIOR TO CONSTRUCTION.
2. FURNISH AND INSTALL NEOPRENE GASKET STRIP WITH 1/2"x7" SLOTS TO MATCH THE WEIR PLATE SHOWN.

WEIR PLATE DETAILS 1

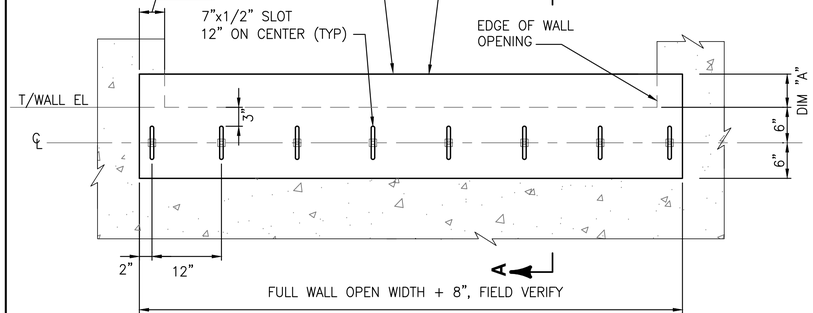
NTS



ELEVATION DETAIL "A" OF WEIR PLATE



ELEVATION DETAIL "B" OF WEIR PLATE



ELEVATION DETAIL "C" OF WEIR PLATE

WEIR NO.	LOCATION	FULL WALL OPEN WIDTH	WEIR INVERT EL	T/CONC EL	ELEVATION DETAIL	DIM "A"
CC-W-1	CCT NO. 1	3'-0"	184.00	183.75	B	3"
CC-W-2	CCT NO. 2	3'-0"	184.00	183.75	B	3"

NOTES:

1. WEIR INVERT ELEVATION IS WITH THE WEIR SET IN THE CENTER OF THE MOUNTING SLOTS.

WEIR PLATE ELEVATION AND SCHEDULE 3

NTS

NOT USED 2

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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PROJECT NO: 03780-001-01
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INDEX NO:
DWG NO: M36

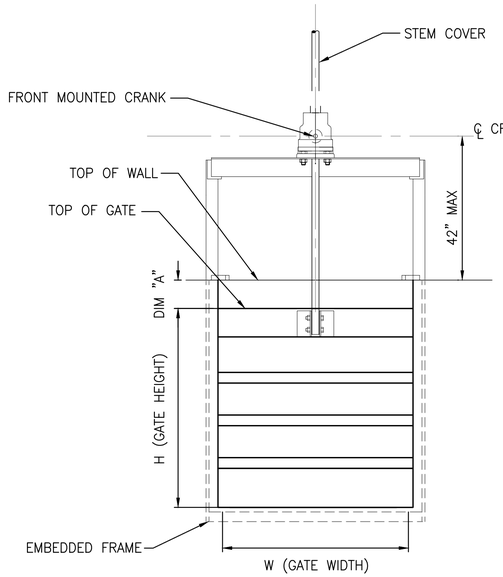
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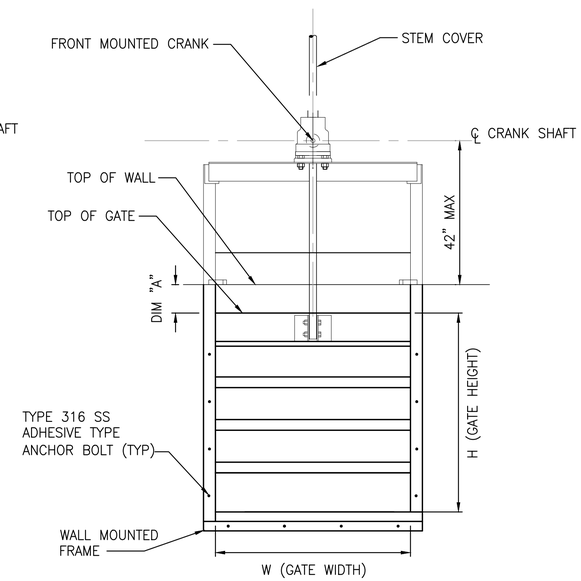
GATE NO.	LOCATION	GATE OPENING (W x H)	DIM "A"	GATE TYPE	FRAME TYPES	SEATING/UNSEATING HEAD CONDITION	OPERATOR TYPE	MATERIAL OF CONSTRUCTION	STEM
CC-G-1	CHLORINE CONTACT BASIN	4'-0" X 4'-0"	0.68'	SLIDE	SCF/EF	UNSEATING	CRANK/MANUAL	316 SS	316 SS/SINGLE
CC-G-2	CHLORINE CONTACT BASIN	4'-0" X 4'-0"	0.68'	SLIDE	SCF/EF	UNSEATING	CRANK/MANUAL	316 SS	316 SS/SINGLE
CC-G-3	TRANSFER PUMP STA	4'-0" X 4'-0"	14.50'	SLIDE	SCF/EF	UNSEATING	CRANK/MANUAL	316 SS	316 SS/SINGLE
CC-SG-1	TRANSFER PUMP STA POND PIPES	2'-0" X 2'-0"	7.00'	SLUICE	WMF	SEATING	MOTOR ACTUATED	316 SS	316 SS/SINGLE
CC-SG-2	TRANSFER PUMP STA POND PIPES	2'-0" X 2'-0"	7.00'	SLUICE	WMF	SEATING	MOTOR ACTUATED	316 SS	316 SS/SINGLE

ABBREVIATION

G	SLIDE GATE
WG	WEIR GATE
SG	SLUICE GATE
SCF	SELF-CONTAINED FRAME
WMF	WALL MOUNTED FRAME
EF	EMBEDDED FRAME
SS	STAINLESS STEEL



TYPICAL EMBEDDED FRAME



TYPICAL WALL MOUNTED FRAME

NOTES:
1. DIM "A" REQUIRES VERIFICATION AND/OR COORDINATION BY CONTRACTOR WITH RESPECT TO APPROVED GATE SHOP DRAWING PRIOR TO CONSTRUCTION OF STRUCTURE.

SLUICE AND SLIDE GATE DETAILS

NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

DESIGNED TFRIEDRICH
DRAWN JKRAMER
CHECKED SMENARD

JonesEdmunds
730 NE WALDO ROAD, GAINESVILLE, FLORIDA 32641 / (352) 377-5821

NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

Thomas W. Friedrich, State of Florida, Professional Engineer, License No. 61281

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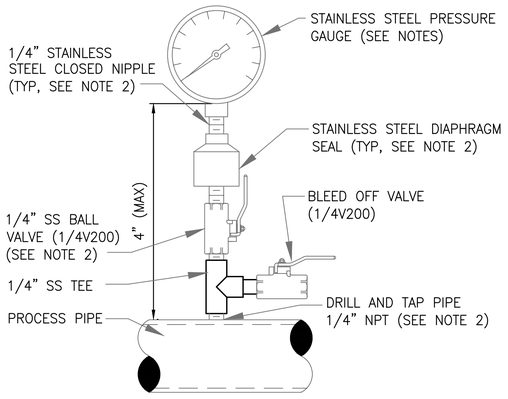
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PROJECT NO: 03780-001-01
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DWG NO: M37

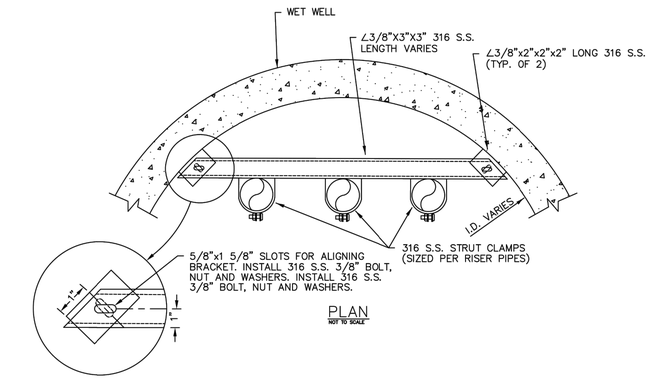
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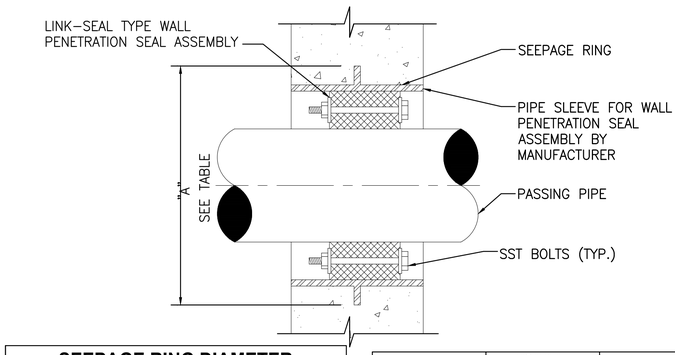
NOTES:
1. SIZE, TYPE, PRESSURE RANGE AND MANUFACTURER PER SPECIFICATIONS DIVISIONS 11 AND DIVISION 15.
2. PRESSURE GAUGES WHERE INDICATED ON DRAWINGS AND DISCHARGE OF ALL PUMPS. CONTRACTOR TO COORDINATE LOCATION WITH OWNER DURING CONSTRUCTION.
3. VERIFY SIZE OF LOWER CONNECTION PRIOR TO PURCHASING ANCILLARY PARTS OR DRILLING AND TAPPING.



PRESSURE GAUGE DETAIL 1
NTS



RISER PIPE SUPPORT BRACKET DETAIL 2
NTS

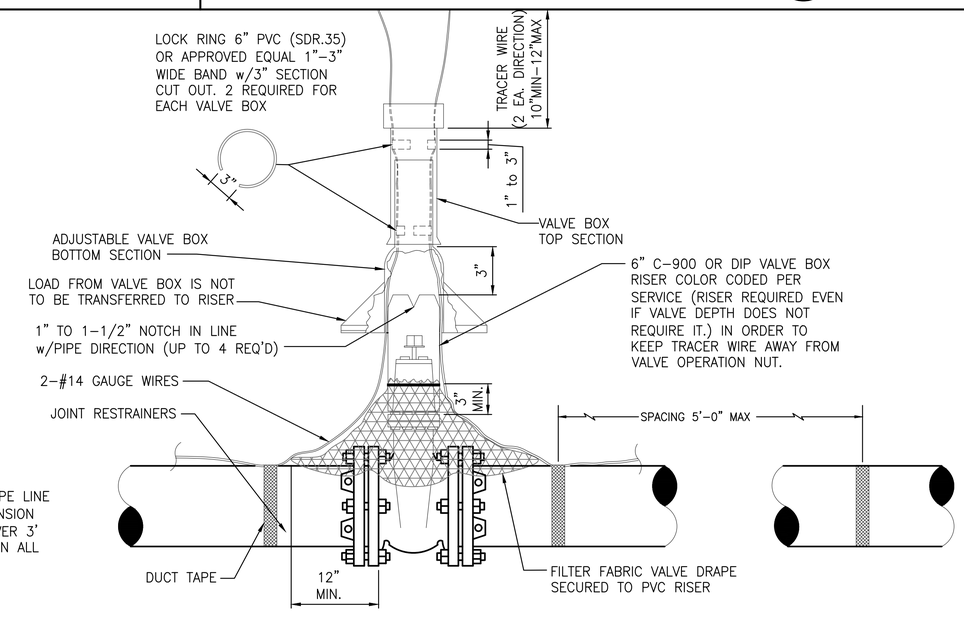


SEEPAGE RING DIAMETER		
PIPE SIZE	NOMINAL SLEEVE DIA	"A"
2	4	6
2 1/2	4	7
3	5	7 1/2
4	6	9
6	10	13
8	12	15
10	14	17

PIPE SIZE	NOMINAL SLEEVE DIA	"A"
12	16	19
14	18	21
16	20	23 1/2
18	24	25
20	24	27 1/2
24	30	32

NOTE:
1. ALL DIMENSIONS IN TABLE ABOVE ARE IN INCHES.

CONCRETE PENETRATION / SEAL DETAIL 3
NTS



NOTE:

FILTER FABRIC REQUIRED ON VALVES WHEN PIPE LINE HAS 5' OR MORE OF COVER VALVE KEY EXTENSION REQUIRED ON VALVES WITH OPERATOR NUT OVER 3' DEEP. COLOR CODED POLY WRAP REQUIRED ON ALL BURIED VALVES AND FITTINGS.

VALVE BOX W/ TRACER WIRE DETAIL 4
NTS

BID SUBMITTAL

LTR.	DATE	REVISIONS	BY	APPRD.

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NORTH FLORIDA MEGA INDUSTRIAL PARK
WASTEWATER TREATMENT PLANT
COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

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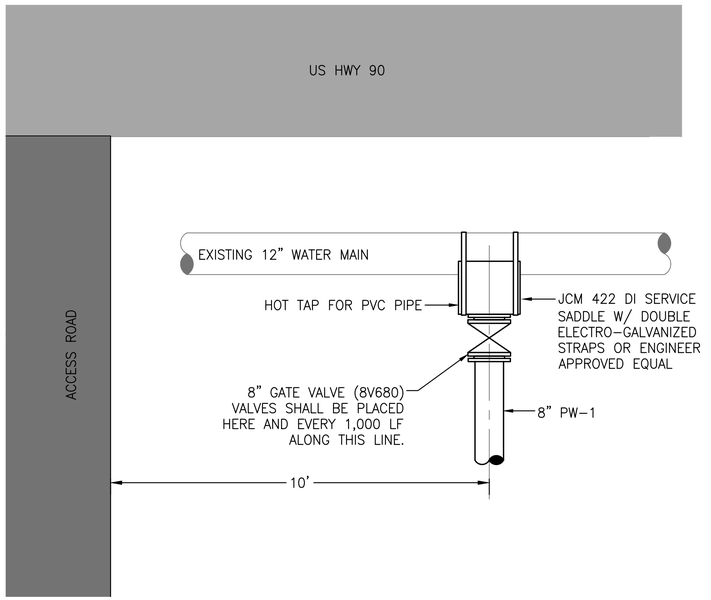
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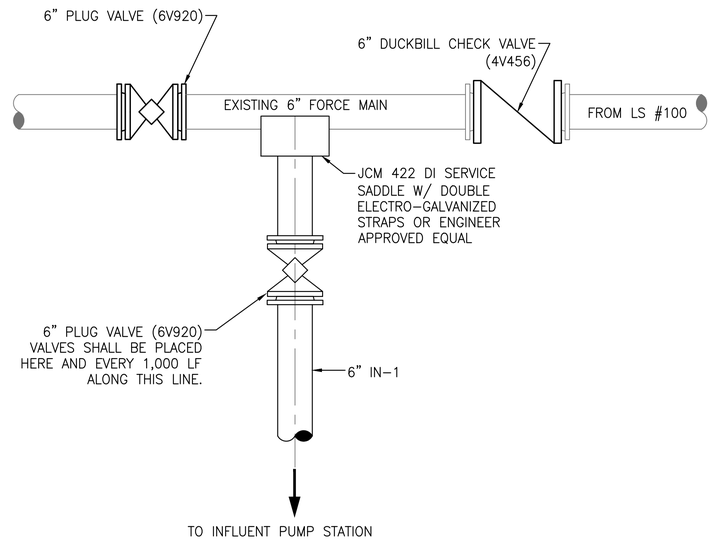
PROJECT NO: 03780-001-01
DATE: APRIL 2022
INDEX NO:
DWG NO: M38

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NOTES:

1. CONTRACTOR SHALL CONDUCT UNDERGROUND INVESTIGATION TO LOCATE EXISTING UTILITIES TO INCLUDE GAS, WATER, SEWER, FIBER OPTIC AND POWER PRIOR TO EXCAVATION.
2. TAP ONLY TO BE INSTALLED AFTER ALL PIPE HAS BEEN INSTALLED, AND WITH OWNER APPROVAL.

NOT USED 1 / –

POTABLE WATER CONNECTION* 2 / –
NTS

* NSF / ANSI 61 COMPLIANT

SANITARY FORCEMAIN CONNECTION @ US HWY 90 3 / –
NTS

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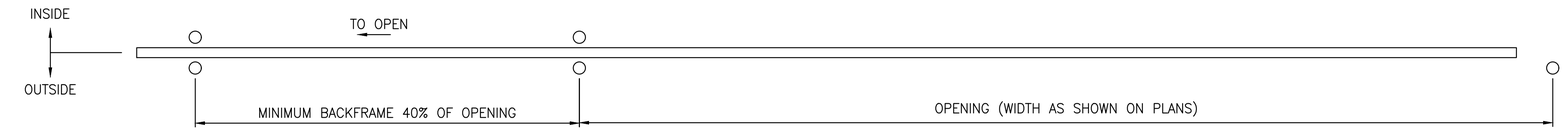
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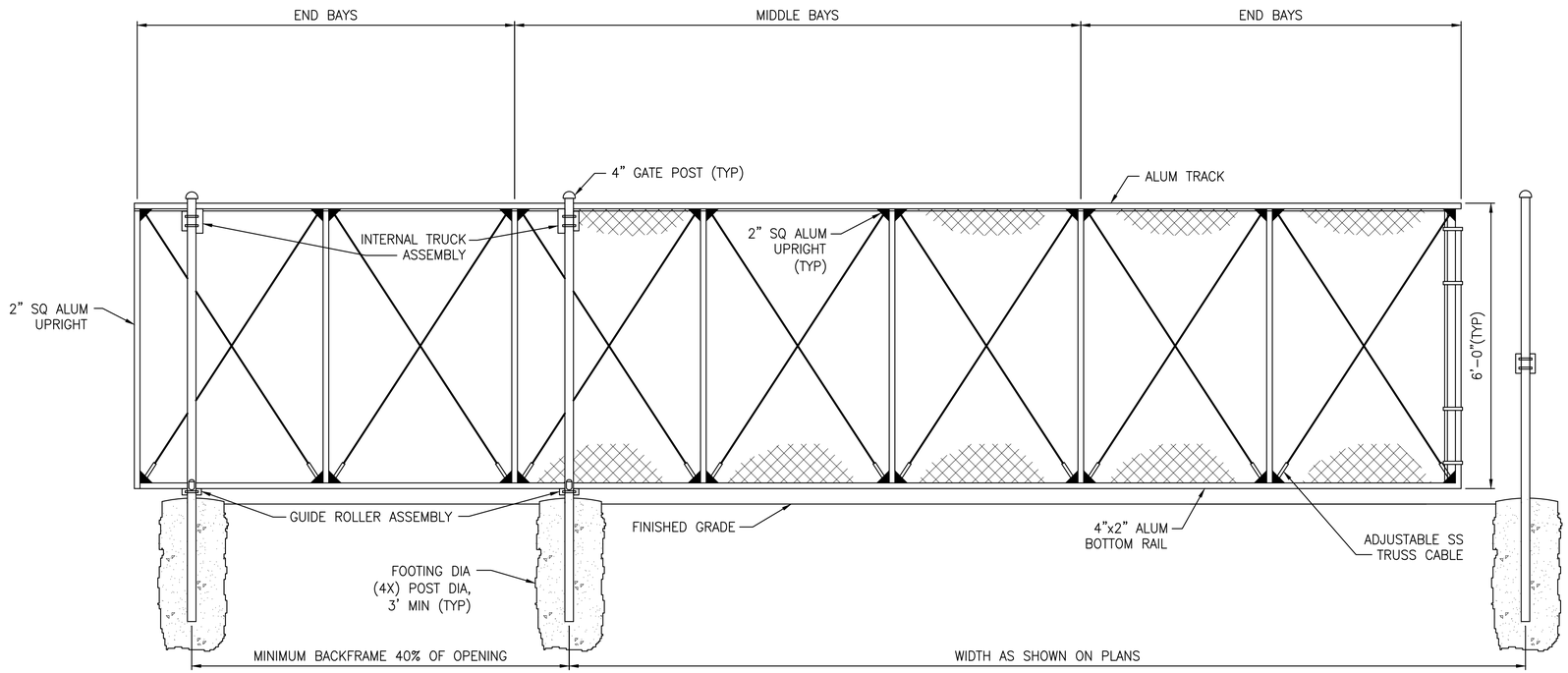
PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO:
	M39

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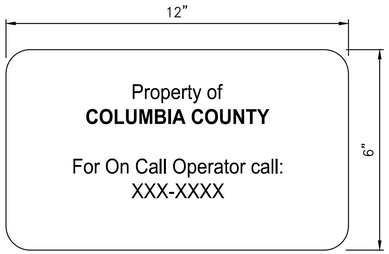
PLAN



NOTE:
VERTICAL AND HORIZONTAL MEMBERS MAX 8' OC.

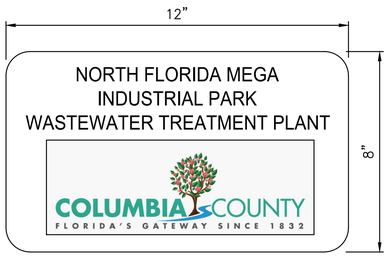
ELEVATION

CANTILEVERED SLIDING GATE DETAIL 1
NTS



NOTE:
SIGN TO BE MADE OF DURABLE WEATHER-RESISTANT MATERIAL

ON-CALL OPERATOR CONTACT SIGN 2
NTS



NOTE:
SIGN TO BE MADE OF DURABLE WEATHER-RESISTANT MATERIAL

FACILITY IDENTIFICATION SIGN 3
NTS

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COLUMBIA COUNTY, FLORIDA

MECHANICAL DETAILS

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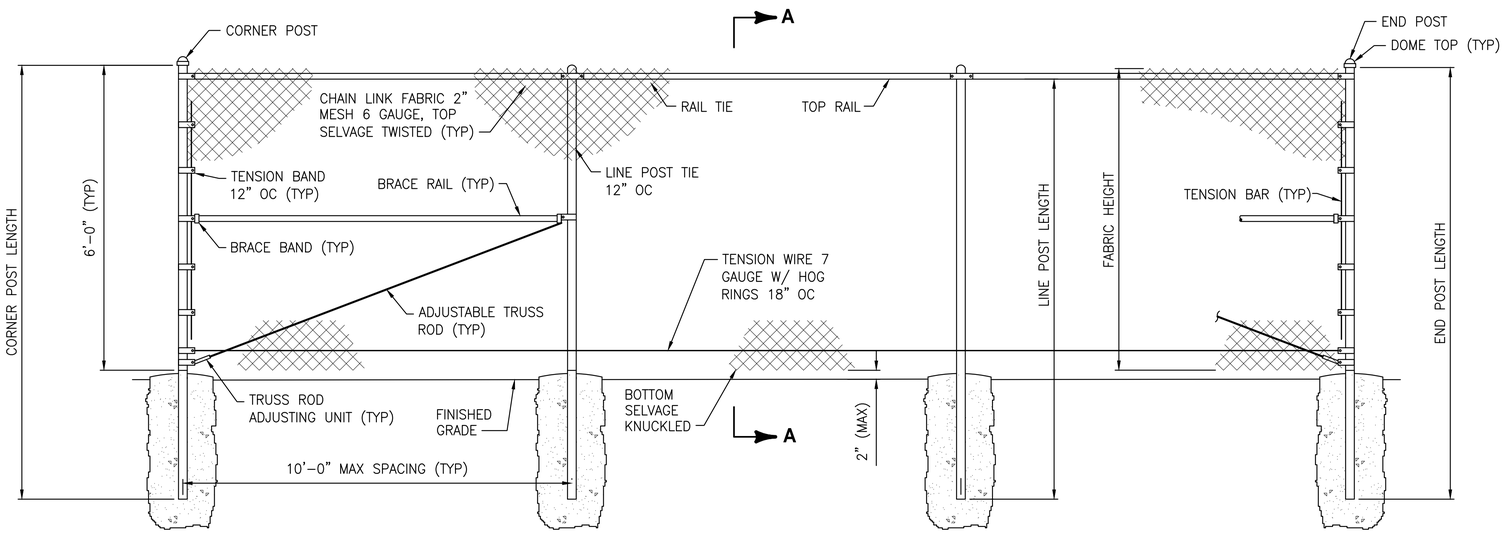
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PROJECT NO:	DATE:
03780-001-01	APRIL 2022
INDEX NO:	DWG NO: M40

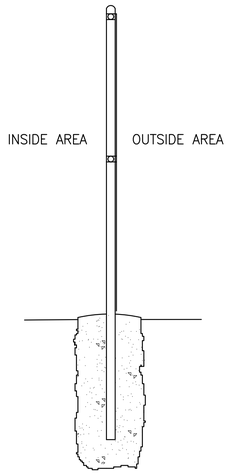
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CHAIN LINK FENCE DETAIL 1

NTS



SECTION A-A

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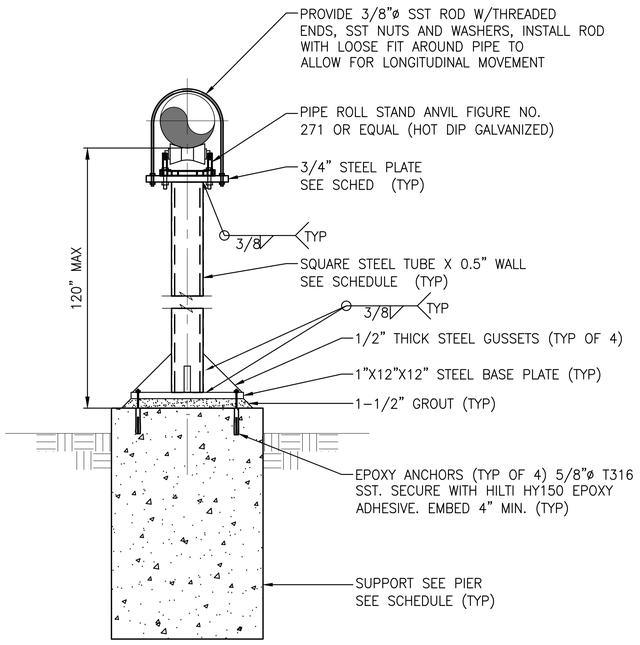
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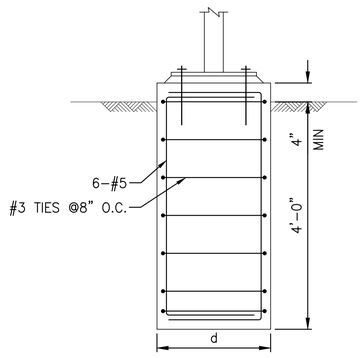
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DWG NO: M41

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TYPICAL AIR PIPE SUPPORT AND PIER



DUCT DIAMETER	FOOTING DIAMETER (d)
12"	24"
16"	28"
20"	36"
24"	42"

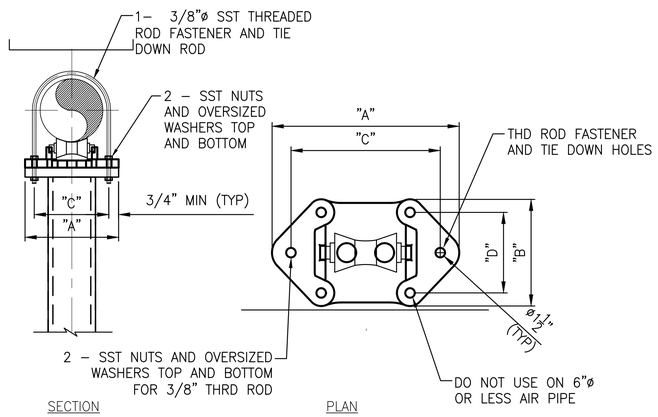
SUPPORT PIER AND PIER SCHEDULE

ROLL STAND ASSEMBLY SCHEDULE (1)

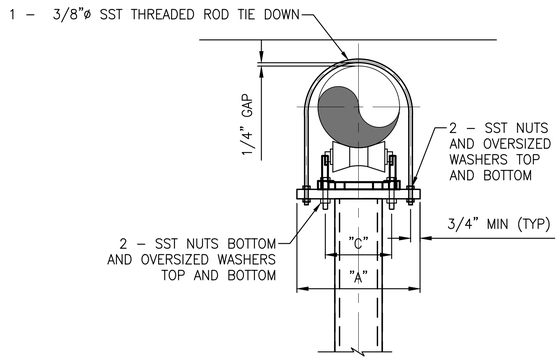
PIPE SIZE	TUBE SIZE	PLATE LENGTH "A"	PLATE WIDTH "B"	BOLT HOLES "C"	BOLT HOLES "D"
2	4x4x.5	8.375	U+2	6.375	4
2 1/2	4x4x.5	8.375	U+2	6.375	4
3	4x4x.5	8.375	U+2	6.375	4
3 1/2	4x4x.5	8.375	U+2	6.375	4
4	4x4x.5	9.875	U+2	7.875	4.25
5	5x5x.5	9.875	U+2	7.875	4.25
6	5x5x.5	9.875	U+2	7.875	4.25
8	5x5x.5	PIPE DIA + 5	U+2	7	5
10	5x5x.5	PIPE DIA + 5	U+2	7	5
12	5x5x.5	PIPE DIA + 5	U+2	9.0	6
14	5x5x.5	PIPE DIA + 5	U+2	9.0	6
16	6x6x.5	PIPE DIA + 5	U+2	10.25	6.5
18	6X6X.5	PIPE DIA + 5	U+2	10.25	6.5
20	6X6X.5	PIPE DIA + 5	U+2	10.25	6.5
24	6X6X.5	PIPE DIA + 5	U+2	11.375	6.5

NOTES:

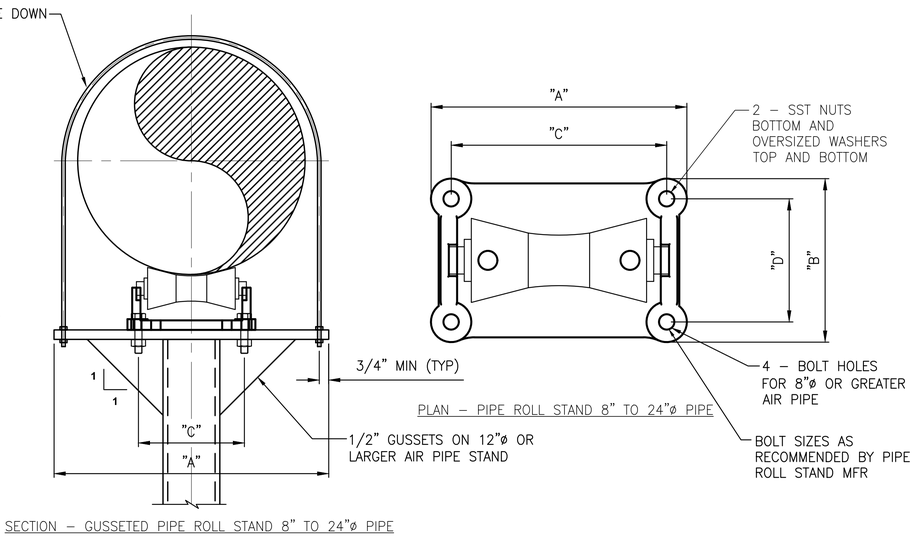
1. DIMENSIONS GIVEN IN SCHEDULE ARE BASED UPON ANVIL FIGURE NO. 271 PIPE ROLL STAND PUBLISHED DIMENSIONS. CONTRACTOR SHALL VERIFY PLATE DIMENSIONS AND HOLE LOCATIONS AND SIZES PRIOR TO FABRICATION.
2. ALL DIMENSIONS SHOWN ARE IN INCHES.



PIPE ROLL STAND 6"ø PIPE OR LESS



SECTION - NON-GUSSETED PIPE ROLL STAND 6"ø OR LESS



PLAN - PIPE ROLL STAND 8" TO 24"ø PIPE

SECTION - GUSSETED PIPE ROLL STAND 8" TO 24"ø PIPE

AIR PIPE / AIR DUCT SUPPORT DETAIL 1

NTS

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