

SUPPLEMENTARY CONDITIONS (CONSTRUCTION)

Florida Department of Environmental Protection
State Revolving Fund Program
Supplementary Conditions
for

Formally Advertised
Construction Procurement

**TABLE OF CONTENTS FOR THE FLORIDA DEPARTMENT OF
 ENVIRONMENTAL PROTECTION
 SUPPLEMENTARY CONDITIONS**

Article Number	Article Title	Page
1	DEFINITIONS	FDEP-1
2	PRIVITY OF AGREEMENT/CONTRACT	FDEP-2
3	PROCUREMENT REQUIREMENTS	FDEP-2
4	RESOLUTION OF PROTESTS AND CLAIMS/DISPUTES	FDEP-2
5	CHANGES TO THE BIDDING AND CONTRACT DOCUMENTS	FDEP-3
6	BONDS AND INSURANCE	FDEP-3
7	AWARD OF AGREEMENT/CONTRACT	FDEP-4
8	ITEMIZED CONSTRUCTION COST BREAKDOWN; CONSTRUCTION AND PAYMENT SCHEDULES	FDEP-4
9	FDEP/USEPA ACCESS TO RECORDS AND PROJECT SITE	FDEP-4
10	DISADVANTAGED BUSINESS ENTERPRISES	FDEP-4
11	DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)	FDEP-5
12	EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)	FDEP-6
13	IMMIGRATION REFORM AND CONTROL ACT OF 1986 STATE OF FLORIDA EXECUTIVE ORDER 11-116)	FDEP-12
14	ENVIRONMENTAL COMPLIANCE	FDEP-12
15	FEDERAL LABOR STANDARDS PROVISION	FDEP-12
16	AMERICAN IRON AND STEEL PROVISION	FDEP-12
17	PROHIBITED LOCAL GOVERNMENT CONSTRUCTION PREFERENCES	FDEP-12

Appendix	Title	Page
A	CERTIFICATION OF COMPLIANCE WITH THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS	FDEP-13
B	GOALS AND TIMETABLES FOR MINORITIES AND FEMALES	FDEP-14
C	FEDERAL LABOR STANDARDS PROVISION	FDEP-15
D	AMERICAN IRON AND STEEL PROVISION	FDEP-23

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

The intent of the Florida Department of Environmental Protection (FDEP) Supplementary Conditions is to complement and supplement other provisions of the Bidding Documents. However, if there is any conflict between the FDEP Supplementary Conditions and other provisions of the Bidding Documents, the FDEP Supplementary Conditions shall take precedence over the other provisions except when the other provisions are similar to, but more stringent than, the FDEP Supplementary Conditions. When other provisions of the Bidding Documents are similar to, but more stringent than, the FDEP Supplementary Conditions, the more stringent provisions shall apply.

ARTICLE 1 - DEFINITIONS

Wherever used in these Supplementary Conditions (except in the appendices to these Supplementary Conditions), the following terms have the meanings indicated, which are applicable to both the singular and plural thereof.

- 1.1 Addendum - A written or graphic instrument that is issued prior to the opening of bids and that clarifies, corrects, or changes the Bidding Documents.
- 1.2 Agreement or Contract - The written agreement between the Owner and the Contractor covering the Work to be performed and furnished; these Supplementary Conditions and other Contract Documents are attached to the Agreement/Contract and made a part thereof as provided therein.
- 1.3 Bid - The offer or proposal of a bidder submitted on the prescribed form and setting forth the price(s) for the Work to be performed and furnished.
- 1.4 Bidder - Any person, firm, or corporation that submits a bid directly to the Owner.
- 1.5 Bidding Documents - The Advertisement for Bids or the Invitation to Bid, the Instructions to Bidders or the Information for Bidders, the Bid Form, the proposed Contract Documents, and all addenda.
- 1.6 Bond - An instrument of security.
- 1.7 Change Order - A document that is recommended by the Engineer and signed by the Contractor and the Owner; that authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time; and that is issued on or after the Effective Date of the Agreement/Contract.
- 1.8 Contract Documents - The Agreement/Contract; the Contractor's Bid when attached as an exhibit to the Agreement/Contract; the Performance and Payment Bond(s); the General Conditions; the Supplementary Conditions (including these Supplementary Conditions); the Specifications (written technical descriptions of material, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto); the Drawings (drawings that show the character and scope of the Work to be performed and furnished); all addenda that pertain to the Contract Documents; and all change orders.
- 1.9 Contract Time - The number of days or the date stated in the Contract Documents for completion of the Work.
- 1.10 Contractor - The person, firm, or corporation with whom or which the Owner enters into the Agreement/Contract.
- 1.11 Effective Date of the Agreement/Contract - The date indicated in the Agreement/Contract on which the Agreement/Contract becomes effective, or if no such date is indicated in the Agreement/Contract, the date on which the Agreement/Contract is signed and delivered by the last of the two parties to sign and deliver the Agreement/Contract.
- 1.12 Engineer - The person, firm, or corporation named as such in the Contract Documents.
- 1.13 Minority Business Enterprise (MBE) - A historically Black college or university or a business that is (a) certified as socially and economically disadvantaged by the Small Business Administration, (b) certified as an MBE by a state or federal agency, or (c) an independent business concern which is at least 51-percent owned and controlled by minority group members. (A minority group member is an individual who is a citizen of the United States and one of the following: [i] Black American; [ii] Hispanic American [with origins from Puerto Rico, Mexico, Cuba, or South or Central America]; [iii] Native American [American Indian, Eskimo, Aleut, or native Hawaiian]; or [iv] Asian-Pacific American

[with origins from Japan, China, the Philippines, Vietnam, Korea, Samoa, Guam, the U.S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia, Taiwan, or the Indian Subcontinent].)

1.14 Notice to Proceed -The written notice given by the Owner to the Contractor fixing the date on which the Contract Time will commence to run and on which the Contractor shall start to perform its obligations under the Contract Documents.

1.15 Owner - The local government (municipality, county, district, or authority; or any agency thereof; or a combination of two or more of the foregoing acting jointly) with which the Florida Department of Environmental Protection (FDEP) may execute, or has executed, a State Revolving Fund loan agreement and for which the Work is to be provided.

1.16 Project - The total construction or facilities described in a State Revolving Fund loan agreement between the FDEP and the Owner, of which the Work to be provided under the Contract Documents may be the whole or a part.

1.17 Sponsor – The recipient of the State Revolving Fund loan agreement that provides funds for the project.

1.18 Subcontract - A direct contract between a subcontractor and the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.19 Subcontractor - A person, firm, or corporation having a direct contract with the Contractor, or any other subcontractor at any tier, for the furnishing of goods (material and equipment) or the performance of services (including construction) necessary to complete the Work.

1.20 Successful Bidder - The lowest responsive, responsible bidder to whom or which the Owner intends to award the Agreement/Contract.

1.21 Women's Business Enterprise (WBE) - A business that is (a) certified as a WBE by a state or federal agency or (b) an independent business concern which is at least 51-percent owned and controlled/operated by women. (Determination of whether a business is at least 51-percent owned by women shall be made without regard to community property laws [e.g., an otherwise qualified WBE that is 51-percent owned by a married woman in a community property state will not be disqualified because the married woman's husband has a 50-percent interest in the married woman's share of the business; similarly, a business that is 51-percent owned by a married man and 49-percent owned by women will not become a qualified WBE by virtue of the married man's wife having a 50-percent interest in the married man's share of the business].)

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

ARTICLE 2 - PRIVITY OF AGREEMENT/CONTRACT

2.1. The Owner expects to finance this Agreement/Contract with assistance from the FDEP, which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency (USEPA). Neither the State of Florida nor the United States (nor any of their departments, agencies, or employees) will be a party to this Agreement/Contract or any lower-tier subcontract.

ARTICLE 3 - PROCUREMENT REQUIREMENTS

3.1. This Agreement/Contract and the Owner's solicitation and award of this Agreement/Contract are subject to requirements contained in Chapter 62-503 (Revolving Loan Program) and/or Chapter 62-552, Florida Administrative Code as applicable.

ARTICLE 4 - RESOLUTION OF PROTESTS AND CLAIMS/DISPUTES

Resolution of Protests Concerning the Owner's Solicitation and/or Award of this Agreement/Contract:

4.1. Protests concerning the Owner's solicitation and/or award of this Agreement/Contract must be filed in writing with the Owner to be considered.

4.2. All timely written protests concerning the Owner's solicitation and/or award of this Agreement/Contract are to be resolved in accordance with the Owner's dispute resolution process. A copy of the ordinance(s), resolution(s), or written policy (policies) that set forth the Owner's dispute resolution process is included elsewhere in the Bidding Documents or is to be made available by the Owner upon request.

4.3. Neither the (FDEP) nor the USEPA will become a party to, or have any role in resolving, protests concerning the Owner's solicitation and/or award of this Agreement/Contract. Protest decisions made by the Owner cannot be appealed to the FDEP or the USEPA.

Resolution of Claims and Disputes Between the Owner and the Contractor:

4.4. Unless otherwise provided in the Contract Documents, all claims and disputes between the Owner and the Contractor arising out of, or relating to, the Contract Documents or the breach thereof are to be decided by arbitration (if the Owner and the Contractor mutually agree) or in a court of competent jurisdiction within the State of Florida.

4.5. Neither the FDEP nor the USEPA will become a party to, or have any role in resolving, claims and disputes between the Owner and the Contractor.

ARTICLE 5 - CHANGES TO THE BIDDING AND CONTRACT DOCUMENTS

5.1. All changes to the Bidding Documents made subsequent to the FDEP's acceptance of the Bidding Documents and prior to the opening of bids are to be documented via addendum (addenda) to the Bidding Documents; all changes to the Contract Documents made after the opening of bids are to be documented by change order(s) to the Contract Documents. The Owner shall submit all addenda and change orders to the FDEP.

ARTICLE 6 - BONDS AND INSURANCE

Bid Guarantees:

6.1. Each bidder's bid is to be accompanied by a bid guarantee made payable to the Owner in an amount at least equal to five percent of the bidder's maximum bid price and in the form of a certified check or bid bond.

Performance and Payment Bond(s):

6.2. The Contractor shall furnish a combined performance and payment bond in an amount at least equal to 100 percent of the Contract Price (or, if required elsewhere in the Contract Documents, the Contractor shall furnish separate performance and payment bonds, each in an amount at least equal to 100 percent of the Contract Price) as security for the faithful performance and payment of all the Contractor's obligations under the Contract Documents. This(these) bond(s) are to be delivered to the Owner by the Contractor along with the executed Agreement/Contract. The Owner shall forward a copy of this (these) bond(s) to the FDEP.

Insurance:

6.3. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, such liability insurance as is appropriate for the Work being performed and furnished and as will provide protection from claims that may arise out of, or result from, the Contractor's performance and furnishing of the Work (whether the Work is to be performed or furnished by the Contractor or any subcontractor at the Work site) and the Contractor's other obligations under the Contract Documents. This insurance is to include workers' compensation insurance, comprehensive general liability insurance, comprehensive automobile liability insurance, and contractual liability insurance applicable to the Contractor's indemnification obligations and is to be written for not less than the limits of liability and coverages determined by the Owner or required by law, whichever is greater.

6.4. The Owner and/or the Contractor (as required elsewhere in the Contract Documents) shall purchase and maintain, during the period of construction, property insurance upon the Work at the Work site in an amount equal to the full replacement cost of the Work or the full insurable value of the Work. This insurance is to include the interests of the Owner, the Contractor, and all subcontractors at the Work site (all of whom are to be listed as insured or additional insured parties); is to insure against the perils of fire and extended coverage; and is to include "all-risk" insurance for physical loss or damage due to theft, vandalism and malicious mischief, collapse, water damage, and/or all other risks against which coverage is obtainable.

6.5. Before any Work at the Work site is started, the Contractor shall deliver to the Owner certificates of insurance that the Contractor is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents, and the Owner shall deliver to the Contractor certificates of insurance that the Owner is required to purchase and maintain in accordance with Paragraphs 6.3 and 6.4 of this Article and other provisions of the Contract Documents.

ARTICLE 7 - AWARD OF AGREEMENT/CONTRACT

7.1. If this Agreement/Contract is awarded, it is to be awarded to the lowest responsive, responsible bidder. A fixed price (lump sum or unit price or both) agreement/contract is to be used. A clear explanation of the method of evaluating bids and the basis for awarding this Agreement/Contract are included elsewhere in the Bidding Documents. All bids may be rejected when in the best interest of the Owner. After the contract has been awarded, the Owner shall give the Contractor a notice to proceed fixing the date on which the Contract Time will commence to run. The Owner shall forward a copy of this notice to proceed to the FDEP.

ARTICLE 8 - ITEMIZED CONSTRUCTION COST BREAKDOWN; CONSTRUCTION AND PAYMENT SCHEDULES

8.1. The Contractor shall submit to the Owner, within ten calendar days after the Effective Date of this Agreement/Contract, an itemized construction cost breakdown and construction and payment schedules.

8.1.1. The itemized construction cost breakdown, or schedule of values, is to include quantities and prices of items aggregating the Contract Price and is to subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices are to include an appropriate amount of overhead and profit applicable to each item of Work.

8.1.2. The construction, or progress, schedule is to indicate the Contractor's estimated starting and completion dates for the various stages of the Work and is to show both the projected cost of Work completed and the projected percentage of Work completed versus Contract Time.

8.1.3. The payment schedule is to show the Contractor's projected payments cumulatively by month.

ARTICLE 9 – FDEP/USEPA ACCESS TO RECORDS AND PROJECT SITE

9.1. Authorized representatives of the Owner, the FDEP, and the USEPA shall have access to, for the purpose of inspection, the Work site(s), any books, documents, papers, and records of the Contractor that are pertinent to this Agreement/Contract at any reasonable time. The Contractor shall retain all books, documents, papers, and records pertinent to this Agreement/Contract for a period of five years after receiving and accepting final payment under this Agreement/Contract.

NOTE: ARTICLE 10 ONLY APPLIES TO FEDERAL CAP GRANT PROJECTS

ARTICLE 10 - DISADVANTAGED BUSINESS ENTERPRISES

10.1 A goal of five percent of the Contract Price is established for Minority Business Enterprise (MBE) participation in the Work, and a goal of five percent of the Contract Price is established for Women's Business Enterprise (WBE) participation in the Work. If bidders or prospective contractors (including the Contractor) intend to let any lower-tier goods

or services (including construction) subcontracts for any portion of the Work, they shall physically include these percentage goals for MBE and WBE participation in all solicitations for subcontracts and shall take good faith efforts to assure that MBEs and WBEs are utilized, when possible, as sources of goods and services. Good faith efforts are to include the following:

10.1.1. Require Disadvantaged Business Enterprises (DBEs) are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local and Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

10.1.2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.

10.1.3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

10.1.4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

10.1.5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

10.1.6. If the prime contractor awards subcontracts, require the prime contractor to take the steps in paragraphs 10.1.1 through 10.1.5 of this section.

10.2. Within ten calendar days after being notified of being the apparent Successful Bidder, the apparent Successful Bidder shall submit to the Owner documentation of the affirmative steps it has taken to utilize Minority and Women's Business Enterprises (MBEs and WBEs) in the Work and documentation of its intended use of MBEs and WBEs in the Work. The Owner shall keep this documentation on file and shall forward to the FDEP a copy of the apparent Successful Bidder's documentation concerning its intended use of MBEs and WBEs in the Work.

ARTICLE 11 - DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

11.1. The bidder certifies, by submission of this proposal, that neither the bidder nor its principals, nor the bidder's subcontractors nor their principals, are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

11.2. Where the bidder is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

11.3. The bidder also certifies that it and its principals and the bidder's subcontractors and their principals:

11.3.1. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

11.3.2. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph 11.3.1 of this certification; and

11.3.3. Have not within a three-year period preceding this proposal had one or more public transactions (federal, state or local) terminated for cause or default. Where the bidder is unable to certify to any of the above, such owner shall attach an explanation to this proposal.

11.3.4. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

11.3.5. The bidder shall incorporate the foregoing requirements 11.1 through 11.3 in all subcontracts.

ARTICLE 12 - EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

12.1. Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246). (Applicable to contracts/subcontracts exceeding \$10,000)

12.1.1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

12.1.2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in Florida, are as follows:

Goal for female participation: 6.9 percent statewide

Goal for minority participation: (See Appendix B at FDEP-20 for goals for each county)

These goals are applicable to all the Contractor's construction work (whether or not it is federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and non-federally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

12.1.3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

12.1.4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is the State of Florida.

12.1.5. Contractors shall incorporate the foregoing requirements in all subcontracts.

12.2. Equal Opportunity Clause (Applicable to contracts/subcontracts exceeding \$10,000)

During the performance of this contract, the contractor agrees as follows:

12.2.1. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor shall take affirmative action to ensure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

12.2.2. The Contractor shall post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause. The notice can be obtained online at http://www.eeoc.gov/employers/upload/eeoc_self_print_poster.pdf. The Contractor shall state that all qualified applicants be considered without regard to race, color, religion, sex or national origin.

12.2.3. The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

12.2.4. The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

12.2.5. The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

12.2.6. The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

12.2.7. In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

12.2.8. The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs 12.2.1 through 12.2.8 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

12.3. The Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

12.3.1. As used in these specifications:

- a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;
- b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;
- c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
- d. "Minority" includes:
 - (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
 - (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);
 - (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

12.3.2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

12.3.3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

12.3.4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered construction Contractors performing construction work in geographical areas where they do not have a federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

12.3.5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

12.3.6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

12.3.7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

- a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
- b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

- c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
- d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
- e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 12.3.7b above.
- f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
- g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
- h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
- i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
- j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
- k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
- l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
- m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

- n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
- o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
- p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

12.3.8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (12.3.7a through 12.3.7p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

12.3.9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

12.3.10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

12.3.11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12.3.12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

12.3.13. The Contractor, in fulfilling its obligation under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.

12.3.14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

12.3.15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

12.4. Pursuant to 41 CFR 60-1.7, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

- 12.4.1. Affirmative action programs pursuant to 41 CFR 60-2 have been developed and are on file;
- 12.4.2. Documentation of a previous contract or subcontract subject to the equal opportunity clause is available;
- 12.4.3. All reports due under the applicable filing requirements have been filed with the Joint Reporting Committee, the Deputy Assistant Secretary or the Equal Employment Opportunity Commission; and
- 12.4.4. Each prospective construction subcontractor that may be awarded a lower-tier construction subcontract with a price exceeding \$10,000 shall meet the above requirements 12.4.1 through 12.4.3.

12.5. Pursuant to 41 CFR 60-1.8, if the price of this bid exceeds \$10,000, the bidder, by signing and submitting this proposal, certifies the following:

- 12.5.1. That he/she does not maintain or provide for his/her employees any segregated facility at any of his/her establishments;
- 12.5.2. That he/she does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained;
- 12.5.3. That he/she will not maintain or provide for employees any segregated facilities at any of his/her establishments;
- 12.5.4. That he/she will not permit employees to perform their services at any location under his/her control where segregated facilities are maintained;
- 12.5.5. That a breach of this certification is violation of the Equal Opportunity Clause of this contract; and
- 12.5.6. That he/she will obtain identical certifications from proposed Subcontractors prior to the award of Subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his/her files.

As used in this certification, the term “segregated facilities” means any waiting rooms, work eating areas, time clocks, locker rooms, and other storage or dressing areas, transportation and housing facilities provided for employees which are in fact segregated on the basis of race, color, religion, or otherwise.

12.6. If the price of this Agreement/Contract exceeds \$10,000, the Owner shall give written notice to the Director of the Office of Federal Contract Compliance Programs within ten working days of award of this Agreement/Contract. The notice is to include the name, address, and telephone number of the Contractor; the employer identification number of the Contractor; the dollar amount of this Agreement/Contract; the estimated starting and completion dates of this Agreement/Contract; the number of this Agreement/Contract; and the geographical area in which the Work is to be performed.

12.7. If the price of this Agreement/Contract equals or exceeds \$50,000 and if the Contractor has 50 or more employees, the Contractor shall electronically file Standard Form 100 (EEO-1) online at <https://egov.eeoc.gov/eeo1/eeo1.jsp> within 30 calendar days after the award of this Agreement/Contract, unless the Contractor has submitted such a report within 12 months preceding the date of award of this Agreement/Contract. In addition, the Contractor shall ensure that each construction subcontractor having 50 or more employees and a lower-tier construction subcontract with a price equaling or exceeding \$50,000 also electronically files this form within 30 calendar days after the award to it of the lower-tier construction subcontract, unless the construction subcontractor has submitted such a report within 12 months preceding the date of award of the lower-tier construction subcontract.

ARTICLE 13 - IMMIGRATION REFORM AND CONTROL ACT OF 1986 (STATE OF FLORIDA EXECUTIVE ORDER 11-116)

The Immigration Reform and Control Act of 1986 prohibits employers from knowingly hiring illegal workers. The Contractor shall only employ individuals who may legally work in the United States – either U.S. citizens or foreign citizens who are authorized to work in the U.S. The Contractor shall use the U.S. Department of Homeland Security’s E-Verify Employment Eligibility Verification system (<http://www.uscis.gov/portal/site/uscis>) to verify the employment eligibility of:

- all new employees, during the term of this Agreement, to perform employment duties within Florida; and,
- all new employees (including subcontractors and subrecipients) assigned by the Contractor to perform work pursuant to this Agreement.

The Contractor shall include this provision in all subcontracts/subgrants it enters into for the performance of work under this Agreement.

ARTICLE 14 – ENVIRONMENTAL COMPLIANCE

The Contractor, and all subcontractors at any tier, shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act (42 U.S.C. 1857[h]), Section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738 (Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans).

ARTICLE 15 – FEDERAL LABOR STANDARDS PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with the Federal Labor Standards Provisions as provided in Appendix C. Signing Appendix A certifies compliance with these provisions.

ARTICLE 16 – AMERICAN IRON AND STEEL PROVISION

Contracts being constructed with assistance from the State Revolving Fund Program are currently required to comply with The American Iron and Steel Provision as provided in Appendix D. Signing Appendix A certifies compliance with these provisions.

ARTICLE 17 - PROHIBITED LOCAL GOVERNMENT CONSTRUCTION PREFERENCES

- A. Pursuant to Section 255.0991, F.S., for a competitive solicitation for construction services in which 50 percent or more of the cost will be paid from state-appropriated funds which have been appropriated at the time of the competitive solicitation, a state, college, county, municipality, school district, or other political subdivision of the state may not use a local ordinance or regulation that provides a preference based upon:
1. The contractor’s maintaining an office or place of business within a particular local jurisdiction;
 2. The contractor’s hiring employees or subcontractors from within a particular local jurisdiction; or
 3. The contractor’s prior payment of local taxes, assessments, or duties within a particular local jurisdiction.
- B. For any competitive solicitation that meets the criteria in Paragraph A., a state college, county, municipality, school district, or other political subdivision of the state shall disclose in the solicitation document that any applicable local ordinance or regulation does not include any preference that is prohibited by Paragraph A.

**APPENDIX A TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS**

**CERTIFICATION OF COMPLIANCE WITH THE FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS**

This certification relates to a construction contract proposed by _____,
(insert the name of the Owner)

which expects to finance the proposed construction contract with assistance from the Florida Department of Environmental Protection (which administers a State Revolving Fund loan program supported in part with funds directly made available by grants from the United States Environmental Protection Agency). I am the undersigned prospective construction contractor or subcontractor.

I certify that I have read the Florida Department of Environmental Supplementary Conditions and agree to incorporate the following articles into the bid and/or contract:

- ARTICLE 11 DEBARMENT AND SUSPENSION (EXECUTIVE ORDER 12549)
- ARTICLE 12 EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)
- ARTICLE 13 IMMIGRATION REFORM AND CONTROL ACT OF (STATE OF FLORIDA EXECUTIVE ORDER 11-116)
- ARTICLE 14 ENVIRONMENTAL COMPLIANCE
- ARTICLE 15 FEDERAL LABOR STANDARDS PROVISION
- ARTICLE 16 AMERICAN IRON AND STEEL PROVISION

I agree that I will obtain identical certifications from prospective lower-tier construction subcontractors prior to the award of any lower-tier construction subcontracts with a price exceeding \$2,000. I also agree that I will retain such certifications in my files.

(Signature of Authorized Official) (Date)

(Name and Title of Authorized Official [Print or Type])

(Name of Prospective Construction Contractor or Subcontractor [Print or Type])

(Address and Telephone Number of Prospective Construction Contractor or Subcontractor [Print or Type])

(Employer Identification Number of Prospective Construction Contractor or Subcontractor)

APPENDIX B TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

GOALS AND TIMETABLES FOR MINORITIES AND FEMALES

[Note: These goals and timetables are the goals and timetables referred to in Paragraph 2 of the "Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246)"; these goals and timetables are to be included in all FDEP assisted construction contracts and subcontracts with a price exceeding \$10,000 and in all solicitations for such contracts and subcontracts.]

The following goals and timetables for female utilization shall be included in all federal and federally assisted construction contracts and subcontracts in excess of \$10,000. The goals are applicable to the contractor's aggregate on-site construction workforce whether or not part of that workforce is performing work on a federal or federally assisted construction contract or subcontract.

Area covered: Goals for Women apply nationwide.

Goals and Timetables

Timetable	Goals (percent)
Indefinite	6.9

Goals for minority utilization can be found in the Department of Labor's Technical Assistance Guide for Federal Construction Contractors (May 2009), available on the internet at <http://www.civilrightsusa.gov/pdf/TAG%20-%20Constuction.pdf>. These goals shall be included for each craft and trade in all federal or federally assisted construction contracts and subcontracts in excess of \$10,000 to be performed in the respective geographical areas. The goals are applicable to each nonexempt contractor's total onsite construction workforce, regardless of whether or not part of that workforce is performing work on a federal, federally assisted or non-federally related project, contract or subcontract.

Construction contractors which are participating in an approved Hometown Plan (see 41 CFR 60-4.5) are required to comply with the goals of the Hometown Plan with regard to construction work they perform in the area covered by the Hometown Plan. With regard to all their other covered construction work, such contractors are required to comply with the applicable SMSA or EA goal contained in this Appendix.

APPENDIX C
TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUPPLEMENTARY CONDITIONS

Davis-Bacon Requirements

FEDERAL LABOR STANDARDS PROVISIONS

(Davis-Bacon Act, Copeland Act, and Contract Works Hours & Safety Standards Act)

The Project to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions are included in this Contract pursuant to the provisions applicable to such federal assistance.

1 Minimum Wages.

(i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act, 29 CFR Part 3, the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period.

Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR Part 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR Part 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) (a) The sponsor, on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The FDEP shall approve a request for an additional classification and wage rate and fringe benefits; therefore, only when the following criteria have been met:

- (1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- (2) The classification is utilized in the area by the construction industry; and
- (3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sponsor(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the sponsor to the FDEP. The FDEP will transmit the request to the Administrator of the Wage and Hour Division, employment Standards Administration, U. S. Department of Labor. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional

classification action within 30 days of receipt and so advise the FDEP or will notify FEDP within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event that the Contractor, the laborers or mechanics to be employed in the Classification or their representatives, and the sponsor do not agree on the proposed classification and wage rate (including the amount designed for fringe benefits, where appropriate), the FDEP shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of FDEP, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(b) or (c) of this paragraph, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, that the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account, assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. Withholding.

The sponsor shall, upon written request of the EPA or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, EPA may, after written notice to the contractor, sponsor, applicant, or owners, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

3. Payrolls and Basic Records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017).

(ii) (a) The contractor shall submit weekly for each week in which any contract work is performed, a copy of all payrolls to the sponsor. Such documentation shall be available upon request by FDEP. As to each payroll copy received, the sponsor shall provide a certification that the project is in compliance with the requirements of 29 CFR 5.5(a)(1) with each disbursement request. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR Part 5.5(a)(3)(I), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current addresses of each covered worker, and shall provide them upon request to the sponsor for transmission to the FDEP or EPA if requested by EPA, the FDEP, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsor. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149).

(b) Each payroll submitted shall be accompanied by a Statement of Compliance, signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR Part 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR Part 5.5 (a)(3)(I), and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Option Form WH-347 shall satisfy the requirement for submission of the Statement of Compliance required by paragraph A. 3(ii)(b) of this section.

(d) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph A.3(I) of this section available for inspection, copying, or transcription by authorized representatives of the FDEP or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FDEP may, after written notice to the contractor, or sponsor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request to make such records available may be grounds for debarment action pursuant to 29 CFR Part 5.12.

4. Apprentices and Trainees.

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U. S. Department of Labor, the Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio

of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program, shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with the determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U. S. Department of Labor, the Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program the contract will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal Employment Opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. Compliance with Copeland Act Requirements.

The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract.

6. Subcontracts.

The contractor or subcontractor will insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR Part 5.5.

7. Contract Termination, Debarment.

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

8. Compliance with Davis-Bacon and Related Act Requirements.

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3 and 5 are herein incorporated by referenced in this contract.

9. Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6 and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the sponsor, FDEP, EPA, the U. S. Department of Labor, or the employees or their representatives.

10. Certification of Eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1) or to be awarded EPA contracts or participate in EPA programs pursuant to Executive Order 12549.

(iii) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U. S. C. 1001. Additionally, U. S. Criminal Code, Section 1010, Title 18, U. S. C., Federal Housing Administration transactions, provides in part "Whoever, for the purpose of . . . influencing in any way the action of such Administration . . . makes, utters or publishes any statement, knowing the same to be false . . . shall be fined not more than \$5,000 or imprisoned not more than two years, or both".

11. Complaints, Proceedings, or Testimony by Employees.

A. No laborer or mechanic to whom the wage, salary, or other labor standards provisions of this contract are applicable shall be discharged or in any other manner discriminated against by the contractor or any subcontractor because such employee has filed any complaint or instituted or caused to be instituted any proceeding or has testified or is about to testify in any proceeding under or relating to the labor standards applicable under this contract to his employer.

B. Contract Work Hours and Safety Standards Act. The sponsor shall insert the following clauses set forth in paragraphs B.(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by item 3 above or 29 CFR 4.6. As used in the paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in subparagraph (1) of this paragraph, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (1) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in subparagraph (1) of this paragraph.

(3) Withholding for unpaid wages and liquidated damages. The sponsor, upon written request of the FDEP or an authorized representative of the Department of Labor, may withhold or cause to be withheld, from any moneys payable on

account of work performed by the contractor or subcontractor under any such contract or any other federal contract with the same prime contract, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (2) of this paragraph.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraph (1) through (4) of this paragraph and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (1) through (4) of this paragraph.

C. Health and Safety

(1) No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

(2) The contractor shall comply with all regulations issued by the Secretary of Labor pursuant to Title 29 Part 1926 (formerly part 1518) and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (Public Law 91-54.83 State 96).

(3) The contractor shall include the provisions of this Article in every subcontract so that such provisions will be binding on each subcontractor. The contractor shall take such action with respect to any subcontract as the Secretary of Housing and Urban Development or the Secretary of Labor shall direct as a means of enforcing such provisions.

12. Guidance to Contractor for Compliance with Labor Standards Provisions

a) Contracts with Two Wage Decisions

If the contract includes two wage decisions, the contractor, and each subcontractor who works on the site, must submit either two separate payrolls (one for each wage decision) or one payroll which identifies each worker twice and the hours worked under each wage decision. One single payroll, reflecting each worker once, may be submitted provided the Contractor uses the higher rate in the wage decisions for each identical job classification. However, where a job classification is not listed in a wage decision and is needed for that portion of the work, the classification **must** be added to the wage decision. A worker may not be paid at the rate for a classification using the hourly rate for that same classification in another wage decision. After the additional classification is approved, the contractor may pay the higher of the two rates and submit one payroll, if desired.

b) Complying with Minimum Hourly Amounts

- 1) The minimum hourly amount due to a worker in each classification is the total of the amounts in the Rates and Fringe Benefits (if any) columns of the applicable wage decision.
- 2) The contractor may satisfy this minimum hourly amount by any combination of cash and bona fide fringe benefits, regardless of the individual amounts reflected in the Rates and Fringe Benefits columns.
- 3) A contractor payment for a worker which is required by law is not a fringe benefit in meeting the minimum hourly amount due under the applicable wage decision. For example, contractor payments for FICA or unemployment insurance are not a fringe benefit; however, contractor payments for health insurance or retirement are a fringe benefit. Generally, a fringe benefit is bona fide if (a) it is available to most workers and (b) involves payments to a third party.
- 4) The hourly value of the fringe benefit is calculated by dividing the contractor's annual cost (excluding any amount contributed by the worker) for the fringe benefit by 2080. Therefore, for workers with overtime, an additional payment may be required to meet the minimum hourly wages since generally fringe benefits have no value for any time worked over 40 hours weekly. (If a worker is paid more than the minimum rates required by the wage decision, this should not be a problem. As long as the total wages received by a worker for straight time equals the hours worked times the minimum hourly rate in the wage decision, the requirement of the Davis-Bacon and Related Acts has been satisfied.)

c) Overtime

For any project work over 40 hours weekly, a worker generally must be paid 150% of the actual hourly cash rate received, not the minimum required by the wage decision. (The Davis-Bacon and Related Acts only establishes minimum rates and does not address overtime. The Contract Work Hours Act contains the overtime requirement and uses basic rate of pay as the base for calculation, not the minimum rates established by the Davis-Bacon and Related Acts.)

d) Deductions

Workers who have deductions, not required by law, from their pay must authorize these deductions in writing. The authorization must identify the purpose of each deduction and the amount, which may be a specific dollar amount or a percentage. A copy of the authorization must be submitted with the first payroll containing the deduction. If deducted amounts increase, another authorization must be submitted. If deducted amounts decrease, no revision to the original authorization is needed. Court-ordered deductions, such as child support, may be identified by the responsible payroll person in a separate document. This document should identify the worker, the amount deducted and the purpose. A copy of the court order should be submitted.

e) Classifications Not Included in the Wage Decision

If a classification not in the wage decision is required, please advise the owner's representative in writing and identify the job classification(s) required. In some instances, the state agency may allow the use of a similar classification in the wage decision.

Otherwise, the contractor and affected workers must agree on a minimum rate, which cannot be lower than the lowest rate for any trade in the wage decision. Laborers (including any subcategory of the laborer classification) and truck drivers are not considered a trade for this purpose. If the classification involves a power equipment operator, the minimum cannot be lower than the lowest rate for any power equipment operator in the wage decision. The owner will provide forms to document agreement on the minimum rate by the affected workers and contractor.

The U.S. Department of Labor (USDOL) must approve the proposed classification and rate. The contractor may pay the proposed rate until the USDOL makes a determination. Should the USDOL require a higher rate, the contractor must make wage restitution to the affected worker(s) for all hours worked under the proposed rate.

f) Supervisory Personnel

Foremen and other supervisory personnel who spend at least 80% of their time supervising workers are not covered by the Davis-Bacon and Related Acts. Therefore, a wage decision will not include such supervisory classifications and their wages are not subject to any minimums under the Davis-Bacon and Related Act or overtime payments under the Contract Work Hours and Safety Standards Act. However, foremen and other supervisory personnel who spend less than 80% of their time engaged in supervisory activities are considered workers/mechanics for the time spent engaged in manual labor and must be paid at least the minimum in the wage decision for the appropriate classification(s) based on the work performed.

g) Sole Proprietorships / Independent Contractors / Leased Workers

The nature of the relationship between a prime contractor and a worker does not affect the requirement to comply with the labor standards provisions of this contract. The applicability of the labor standards provisions is based on the nature of the work performed.

If the work performed is primarily manual in nature, the worker is subject to the labor standards provisions in this contract. For example, if John Smith is the owner of ABC Plumbing and performs all plumbing work himself, then Mr. Smith is subject to the labor standards provisions, including minimum wages and overtime. His status as owner is irrelevant for labor standards purposes.

If a worker meets the IRS standards for being an independent contractor, and is employed as such, this means that the worker must submit a separate payroll as a subcontractor rather than be included on some other payroll. The worker is still subject to the labor standards provisions in this contract, including minimum wages and overtime.

If a contractor or subcontractor leases its workers, they are subject to the labor standards provisions in this contract, including minimum wages and overtime. The leasing firm must submit payrolls and these payrolls must reflect information required to determine compliance with the labor standards provisions of this contract, including a classification for each worker based on the nature of the work performed, number of regular hours worked, and number of overtime hours worked.

h) Apprentices / Helpers

A worker may be classified as an apprentice **only if participating in a federal or state program**. Documentation of participation must be submitted. Generally, the apprentice program specifies that the apprentice will be compensated at a percentage of journeyman rate. For Davis-Bacon Act purposes, the hourly rate cannot be lower than the percentage of the hourly rate for the classification in the applicable wage decision.

If the worker does not participate in a federal or state apprentice program, then the worker must be classified according to duties performed. This procedure may require classification in the trade depending on tools used, or as a laborer if specialized tools of the trade are not used. The contractor may want to consult with the Wage and Hour Division of the U.S. Department of Labor located in most large cities regarding the appropriate classification.

Presently, no worker may be classified as a helper. As with apprentices not participating in a formal apprentice program, the worker must be classified according to duties performed and tools used.

"General Decision Number: FL20200137 01/03/2020

Superseded General Decision Number: FL20190137

State: Florida

Construction Type: Heavy

County: Volusia County in Florida.

HEAVY CONSTRUCTION PROJECTS (Including Sewer and Water Lines)
 (EXCLUDING CAPE CANAVERAL AIR FORCE STATION, PATRICK AIR FORCE
 BASE, KENNEDY SPACE FLIGHT CENTER AND MALABAR RADAR SITE)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2020

ENGI0673-013 05/01/2013

	Rates	Fringes
OPERATOR: Oiler.....	\$ 20.36	10.85

* IRON0808-003 01/01/2019

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 27.28	14.70

LABO0517-002 05/01/2017

	Rates	Fringes
LABORER: Grade Checker.....	\$ 19.20	7.85

PAIN1010-011 08/01/2019

	Rates	Fringes
Painter - Brush, Roller & Spray.....	\$ 24.71	13.50

SUFL2009-176 06/24/2009

	Rates	Fringes
CARPENTER, Excludes Form Work....	\$ 13.56	1.84
CEMENT MASON/CONCRETE FINISHER...	\$ 12.63	0.00
ELECTRICIAN.....	\$ 16.71	3.51
FORM WORKER.....	\$ 11.36	0.00
LABORER: Common or General.....	\$ 9.03	0.81
LABORER: Landscape.....	\$ 8.44	0.00
LABORER: Pipelayer.....	\$ 11.17	1.27
LABORER: Power Tool Operator (Hand Held Drills/Saws, Jackhammer and Power Saws Only).....	\$ 10.63	2.20
OPERATOR: Asphalt Paver.....	\$ 11.88	0.00
OPERATOR: Backhoe Loader Combo.....	\$ 16.10	2.44
OPERATOR: Backhoe/Excavator.....	\$ 13.12	2.58
OPERATOR: Bulldozer.....	\$ 12.88	0.00
OPERATOR: Crane.....	\$ 14.88	3.17
OPERATOR: Grader/Blade.....	\$ 16.00	2.84
OPERATOR: Loader.....	\$ 13.38	0.00
OPERATOR: Mechanic.....	\$ 13.83	2.19
OPERATOR: Roller.....	\$ 10.50	0.00
OPERATOR: Scraper.....	\$ 11.00	1.74
OPERATOR: Trackhoe.....	\$ 20.92	5.50
OPERATOR: Tractor.....	\$ 10.00	0.00
TRUCK DRIVER, Includes Dump Truck.....	\$ 11.07	0.00
TRUCK DRIVER: Lowboy Truck.....	\$ 11.00	0.00
TRUCK DRIVER: Off the Road Truck.....	\$ 12.21	1.97

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that

no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor

200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

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APPENDIX D TO THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION SUPPLEMENTARY CONDITIONS

American Iron and Steel Requirement

The Contractor acknowledges to and for the benefit of the _____ (“Owner”) and the State of Florida (the “State”) that it understands that iron and steel products to be installed as a part of this contract must be in compliance with the requirements in H.R. 3547, “Consolidated Appropriations Act, 2014,” (Appropriations Act). H.R. 3547 includes the following language in Division G, Title IV, Sec. 436, under the heading, “Use of American Iron and Steel,”:

(a) (1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j-12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the “Administrator”) finds that--

- (1) applying subsection (a) would be inconsistent with the public interest;
- (2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
- (3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

For waivers to these requirements based on (2)(b) above, contact Sheryl Parsons at USEPA Region IV. She can be reached by phone at (404) 562-9337.



**CONTRACT DOCUMENTS FOR
CONSTRUCTION OF THE
BIOSOLIDS DEWATERING SYSTEM IMPROVEMENTS
AT THE
WESTSIDE REGIONAL WATER RECLAMATION FACILITY**

ISSUED FOR BID

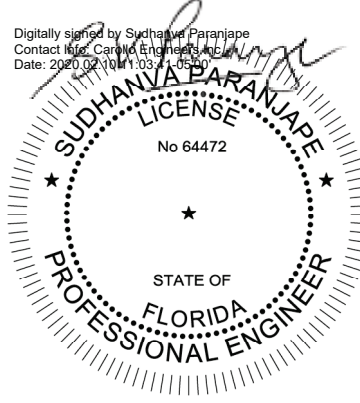
FEBRUARY 2020

**SPECIFICATIONS VOLUME 1
(DIVISIONS 1-13)**



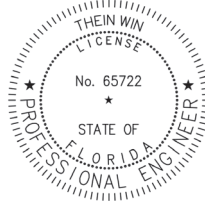
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**CITY OF DAYTONA BEACH
DESIGN OF BIOSOLIDS DEWATERING SYSTEM IMPROVEMENTS
AT THE
WESTSIDE REGIONAL SLUDGE DEWATERING FACILITY IMPROVEMENTS**

<p style="text-align: center;">Sudhanva Paranjape, P.E. FL PE No.64472</p> <p style="text-align: center;">Carollo Engineers, Inc. CA 8571 200 East Robinson St., Ste. 1400 Orlando, Florida 32801 PHONE: (407) 478-4642 • FAX: (407) 478-4643</p>	<p style="text-align: center;"><small>Digitally signed by Sudhanva Paranjape Contact Info: Carollo Engineers, Inc. Date: 2020.02.10 11:33:17 -0500</small></p>  <p style="text-align: center;">Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.</p>
<p>Responsible for: 01010, 01140, 01292, 01294, 01312, 01324B, 01329, 01330, 01400, 01410, 01420, 01460, 01568, 01600, 01610, 01710, 01720, 01756, 01770, 01782, 11360, 11362, 13446, 13448, 14555, 15050, 15052, 15061, 15075, 15076, 15110, 15111, 15116, 15120, 15121, 15211, 15247, 15249, 15286, 15812, 15820, 15830, 15852, 15954, 15956, 15958</p>	

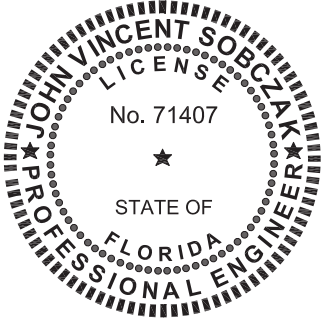
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**CITY OF DAYTONA BEACH
DESIGN OF BIOSOLIDS DEWATERING SYSTEM IMPROVEMENTS
AT THE
WESTSIDE REGIONAL SLUDGE DEWATERING FACILITY IMPROVEMENTS**

<p style="text-align: center;">Thein Win, P.E. FL PE No. 65722</p> <p style="text-align: center;">Hillers Electrical Engineering, Inc. EB 0006877 23257 State Road 7, Suite 100 Boca Raton, FL 33428 PHONE: (561) 451-9165 • FAX: (561) 451-4886</p>	<div style="text-align: center;"></div> <p style="text-align: right;">Digitally signed by Thein Win Date: 2020.02.07 11:07:10 -05'00'</p> <p><small>This item has been digitally signed and sealed by Thein Win, PE. on the date adjacent to the seal.</small></p> <p><small>Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.</small></p>
<p>Responsible for: 16010, 16015, 16050, 16110, 16120, 16405, 16450, 16480, 16485, 16500, 16950, 17000</p>	

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**CITY OF DAYTONA BEACH
DESIGN OF BIOSOLIDS DEWATERING SYSTEM IMPROVEMENTS
AT THE
WESTSIDE REGIONAL SLUDGE DEWATERING FACILITY IMPROVEMENTS**

<p style="text-align: center;">John Sobczak, P.E. FL PE No. 71407</p> <p style="text-align: center;">Wekiva Engineering, LLC CA 31920 711 N. Orange Ave., Suite A Winter Park, FL 32789 Phone: (321)972-4989</p>	<p style="text-align: center;">John Sobczak c=US, o=Wekiva Engineering LLC, ou=A01410C0000016BC 320B0D400001FCD, cn=John Sobczak 16:09:19 2020.02.07 '00'05- 2019.021.20061</p>  <p style="text-align: center;">Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.</p>
<p>Responsible for: 03055, 03071, 03102, 03150, 03200, 03300, 03366, 03600, 03931, 05120, 05140, 05190, 05500, 07900, 08120, 08710, 09910, 09960</p>	

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CITY OF DAYTONA BEACH
BIOSOLIDS DEWATERING SYSTEM IMPROVEMENTS
AT THE WESTSIDE REGIONAL WATER RECLAMATION FACILITY

TABLE OF CONTENTS
VOLUME 1 OF 2

DIVISION 01 – GENERAL REQUIREMENTS

SECTION NO.	TITLE
01010	SUMMARY OF WORK
01140	WORK RESTRICTIONS
01150	MEASUREMENT AND PAYMENT
01292	SCHEDULE OF VALUES
01294	APPLICATIONS FOR PAYMENT
01312	PROJECT MEETINGS
01324B	PROGRESS SCHEDULES AND REPORTS
01329	SAFETY PLAN
01330	SUBMITTAL PROCEDURES
01400	TEMPORARY FACILITIES
01410	REGULATORY REQUIREMENTS
01420	TESTING AND TESTING LABORATORY SERVICES
01460	CONTRACTOR QUALITY CONTROL PLAN
01568	TEMPORARY EROSION AND SEDIMENTATION CONTROL
01600	PRODUCT REQUIREMENTS
01610	PROJECT DESIGN CRITERIA
01710	PROJECT HOUSEKEEPING/CLEANING
01720	AS-BUILTS/RECORD DOCUMENTS
01756	TESTING, TRAINING, AND FACILITY START-UP
01770	CLOSEOUT PROCEDURES
01782	OPERATION AND MAINTENANCE DATA

DIVISION 02 - SITE CONSTRUCTION

SECTION NO.	TITLE
02050	SOILS AND AGGREGATES FOR EARTHWORK
02200	SITE CLEARING
02300	EARTHWORK
02318	TRENCHING
02722	AGGREGATE BASE COURSES
02742	ASPHALTIC CONCRETE PAVING
02952	PAVEMENT RESTORATION AND REHABILITATION

DIVISION 03 - CONCRETE

SECTION NO.	TITLE
03055	ADHESIVE-BONDED REINFORCING BARS AND ALL THREAD RODS
03071	EPOXIES
03102	CONCRETE FORMWORK
03150	CONCRETE ACCESSORIES
03200	CONCRETE REINFORCING
03300	CAST-IN-PLACE CONCRETE
03366	TOOLED CONCRETE FINISHING
03600	GROUTING
03931	EPOXY INJECTION SYSTEM

DIVISION 04 - MASONRY

SECTION NO.	TITLE
04220	CONCRETE UNIT MASONRY

DIVISION 05 - METALS

SECTION NO.	TITLE
05120	STRUCTURAL STEEL
05140	STRUCTURAL ALUMINUM
05190	MECHANICAL ANCHORING AND FASTENING TO CONCRETE AND MASONRY
05500	METAL FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION NO.	TITLE
07900	JOINT SEALANTS

DIVISION 08 - DOORS AND WINDOWS

SECTION NO.	TITLE
08120	ALUMINUM DOORS AND FRAMES
08331	OVERHEAD COILING DOORS
08710	DOOR HARDWARE

DIVISION 09 - FINISHES

SECTION NO.	TITLE
09910	PAINTING
09960	HIGH-PERFORMANCE COATINGS

DIVISION 11 - EQUIPMENT

SECTION NO.	TITLE
11246	POLYMER BLENDING AND FEED EQUIPMENT-LIQUID
11313	HORIZONTAL SPLIT-CASE CENTRIFUGAL WASHWATER PUMPS
11362	BELT FILTER PRESS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION NO.	TITLE
13446	MANUAL ACTUATORS
13448	INTELLIGENT ACTUATORS

VOLUME 2 OF 2

DIVISION 14 – CONVEYING SYSTEMS

SECTION NO.	TITLE
14555	SHAFTLESS SCREW CONVEYORS

DIVISION 15 - MECHANICAL

SECTION NO.	TITLE
15050	COMMON WORK RESULTS FOR MECHANICAL EQUIPMENT
15052	COMMON WORK RESULTS FOR GENERAL PIPING
15061	PIPE SUPPORTS
15075	EQUIPMENT IDENTIFICATION
15076	PIPE IDENTIFICATION
15110	COMMON WORK RESULTS FOR VALVES
15111	BALL VALVES
15116	PLUG VALVES
15120	PIPING SPECIALTIES
15121	PIPE COUPLINGS
15211	DUCTILE IRON PIPE: AWWA C151
15247	POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE
15249	POLYVINYL CHLORIDE (PVC) PIPE: SCHEDULE TYPE
15740	HEAT PUMPS
15954	TESTING, ADJUSTING, AND BALANCING FOR HVAC
15956	PIPING SYSTEMS TESTING
15958	MECHANICAL EQUIPMENT TESTING

DIVISION 16 - ELECTRICAL

SECTION NO.	TITLE
16010	BASIC ELECTRICAL REQUIREMENTS
16015	ELECTRICAL SYSTEMS ANALYSIS
16050	BASIC ELECTRICAL MATERIALS AND METHODS
16110	RACEWAYS
16120	CONDUCTORS
16405	ELECTRIC MOTORS

16450	GROUNDING
16480	LOW VOLTAGE MOTOR CONTROL
16485	VARIABLE FREQUENCY DRIVES
16500	LIGHTING
16950	ELECTRICAL TESTING

DIVISION 17 - INSTRUMENTATION AND CONTROLS

SECTION NO.	TITLE
17000	INSTRUMENTATION AND CONTROLS

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SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Identification and summary description of the Project, the Work, location, coordination, and early occupancy by Owner (City). The word Owner and City are used interchangeably in the entire set of specifications and should be City of Daytona Beach Utilities Department.
- B. Project includes construction of biosolids dewatering system improvements at the existing dewatering building:
 - 1. Currently 3 belt filter presses (BFPs) and a conveyor system (horizontal, inclined and truck loading conveyors) are located on the second floor of the dewatering building. The sludge feed pumps and polymer system are located on the first floor. Polymer solution is injected into the piping on the first floor as shown on the drawings.
 - 2. The dewatering system improvements project will comprise of furnishing and installing of the following.
 - a. Two (2) 3-belt belt filter presses (BFPs) for dewatering waste activated sludge. See Specification Section 11362 for more details.
 - b. Two (2) washwater pumps (one per BFP). See Specification Section 11313 for more details.
 - c. Two (2) Skid-mounted, Emulsion Polymer Blending Units to feed a polymer solution to the BFP (one per BFP). See Specification Section 11246 for more details.
 - d. One (1) horizontal, One (1) inclined shaftless screw conveyor complete with supports, chutes and hoppers. See Specification Section 14555 for more details.
 - e. One shaftless screw truck unloading conveyor. The unloading conveyor will receive the dewatered cake from the set of horizontal and inclined conveyor system as shown on the drawings. See Specification Section 14555 for more details.
 - f. All supporting concrete, structural walkways, supports, pipe, valves, pipe supports, and appurtenances.
 - g. All electrical and instrumentation controls as necessary for the project.

1.02 THE WORK

- A. The Work consists of construction of the Sludge Dewatering Improvements at the Westside Regional Water Reclamation Facility, located at 3651 LPGA Blvd., Daytona Beach, FL 32124 as described herein and shown on drawings of the Contract Documents.

- B. Specific items included in the Work include, but are not limited to, the following:
1. Contractor Mobilization and Demobilization.
 2. Sludge Dewatering Improvements:
 - a. Remove and demolish existing equipment and various piping, conduits, odor control ducts, and panels on the first floor of the dewatering building as shown on the drawings.
 - b. Demolition of walls of the existing building on the first floor and installation of roll-up doors as shown on the drawings.
 - c. Construct a new climate controlled electrical room on 1st floor as shown on the drawings.
 - d. Install new MCC-3, conveyor control panels, and BFP control panels.
 - e. Install new conveyor system.
 - f. Install new 3-belt BFPs and associated washwater pumps and piping as show on the drawings.
 - g. Install new polymer blending units and all associated piping.
 - h. Install new sludge feed piping to each BFP from the existing sludge feed pumps as shown on the drawings. Install a polymer injection ring and mixing valve on the discharge of each sludge feed pump downstream of the existing magnetic flow-meter. Coordinate and follow directions of BFP manufacturer on the type and location of the polymer injection and mixing valve as desired. Install new polymer solution piping to the polymer injection ring.
 - i. Construct new polymer tote storage area as shown on the drawings.
 - j. Integrate BFP and conveyor programming into the new BFP Master Control Panel (PCP-DW).
 - k. Pour new BFP containment area curb walls and new BFP supports per approved shop drawings for the new BFPs.
 - l. Cut existing floor for new floor drains/trenches as shown on the drawings.
 - m. Fill all recessed areas on the 1st floor with concrete as indicated on the drawings.
 - n. Paint walls of the new belt press room on the first floor.
 - o. Contractor shall procure and set up a rental trailer mounted complete biosolids dewatering system (capable of handling a minimum of 300 gallons per minute of waste activated sludge (WAS) at 0.6 percent total suspended solids (TSS) on a continuous basis to handle the biosolids at the plant during such a time that the existing dewatering operation has to be taken off-line for construction inside the dewatering building. The trailer shall have a skid mounted dewatering equipment such as a belt filter press or screw press or high solids centrifuge and equipped with a progressive cavity feed pump, liquid polymer tote storage, blending and feed system, washwater pump and cake loading conveyor to allow for taking the existing dewatering operation at the plant offline for construction modifications. The cake conveyor shall be self-supporting and capable of mounting at a sufficient angle to off-load the dewatered cake into a truck for hauling off-site. The trailer shall be all equipped with necessary interconnecting piping, valves, ancillary supports etc. and all electrical and instrumentation and controls and should be a plug-and-play type ready to dewater municipal WAS. CONTRACTOR shall provide sufficiently long hose pipes of sufficient size for connecting to the WAS source, washwater source and nearby drain and necessary electrical hook-up. This temporary dewatering system shall be capable of producing a minimum dewatered cake of 14 percent cake solids at all time.

CONTRACTOR may need to hire the services of such mobile dewatering system companies to visit the site, to test the WAS and determine the polymer type and quantity and to obtain a guarantee to meet the minimum cake dryness requirements. Submit the guarantee to Owner. The time for the rental unit will be determined by the installing CONTRACTOR.

CONTRACTOR shall make every effort to reduce the rental time by providing a detailed project schedule to the Owner and Engineer for approval. CONTRACTOR shall be required to provide a unit price for monthly rental on the bid form. CONTRACTOR shall coordinate with Owner to find a location for the mobile dewatering system and provide all testing, start-up, and mobilization and de-mobilization services for this unit. The trailer will be operated by the City staff as required. City will provide for and pay for all necessary polymer, water and electrical for operating the temporary dewatering system during this period.

- p. Remove and demolish all equipment associated with the four existing BFPs including hydraulic pump units, control panels, and alarm panel as shown on the drawings, located on the second floor of the existing dewatering building.
- q. Remove and demolish existing MCC-3 and other electrical items located on the second floor of the existing building as shown on the drawings.
- r. Demolish existing BFP containment area, and BFP supports, odor control piping, sludge piping, panels etc. on the second floor as shown on the drawings.

C. Except as specifically noted otherwise, provide and pay for:

- 1. Insurance and bonds.
- 2. Labor, materials, and equipment.
- 3. Tools, equipment, and machinery required for construction.
- 4. Utilities required for construction.
- 5. Temporary facilities as necessary.
- 6. Erosion and dust control measures.
- 7. Other facilities and services necessary for proper execution and completion of the Work.

D. City will provide and pay for all water used for flushing, testing, and start-up activities.

E. Comply with codes, ordinances, regulations, orders, and other legal requirements of public authorities having bearing on the performance of the Work.

1.03 OWNER DIRECT PURCHASE EQUIPMENT

A. Owner may elect to direct purchase certain major equipment to purchase tax free in accordance with Fla. Stat. § 212.08(6), and implementing administrative regulations; and all other terms will have the meaning provided or suggested in the Contract, where applicable. Contractor should coordinate with Owner on the list of equipment the Owner may elect to direct purchase. Contractor shall comply with all conditions as described in the General Conditions and/or Contractor Contract as applicable.

- B. Contractor's responsibility for Owner-direct purchase equipment:
 - 1. Deliver supplier's bill of materials to Owner on behalf of Owner.
 - 2. Submit claims for transportation damage on behalf of Owner.
 - 3. Arrange for replacement of damaged, defective, or missing items on behalf of Owner.
 - 4. Arrange for manufacturer's warranties, bonds, service, and inspections.
 - 5. Designating delivery date for each Owner-direct purchase product/equipment.
 - 6. Reviewing shop drawings, O&M manuals, product data, and samples.
 - 7. Transmit all such submittals to Engineer for review and approval.
 - 8. Submitting notification of discrepancies or anticipated problems.
 - 9. Receiving and unloading equipment/products at site.
 - 10. Promptly inspecting products jointly with Owner, Engineer and recording shortages, and damaged or defective items.
 - 11. Handling products at site, including uncrating and storage.
 - 12. Protecting products from damage.
 - 13. Installing, including assembly, connections, adjustments, tests, and finish products in accordance with Contract Documents.
 - 14. Providing operating oils, lubricants, and incidental materials required for complete installation.
 - 15. Repairing or replacing items damaged after receipt until date of Substantial Completion of the Work by Owner.

1.04 ACTIVITIES BY OTHERS

- A. Owner, utilities, and others may perform activities within Project area while the Work is in progress.
 - 1. Schedule the Work with Owner's representative (Plant Superintendent) and any others to minimize mutual interference.
- B. Cooperate with others to minimize interference and delays.
 - 1. When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.
 - 2. Any interference with plant operations shall be coordinated with Plant Superintendent only.
- C. When the Work depends for proper execution or results upon work performed by others, inspect and promptly report apparent discrepancies or defects in work performed by others.
 - 1. Assume responsibility for work performed by others, except for defects reported as specified in this paragraph and defects, which may become apparent in work performed by others after execution of the Work.

1.05 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.
- C. The minimum clearance requirements specified in the Contract Documents shall not relieve each EQUIPMENT MANUFACTURER from allowing additional clearances for the proper installation, operation, and maintenance of the units. The Contract Drawings only show a general layout. The CONTRACTOR shall be fully responsible

to take field measurements and coordinate with the EQUIPMENT MANUFACTURER, ENGINEER AND OWNER before fabrication of all equipment to prepare a proper layout to provide sufficient access for operation and maintenance. Adequate space shall be maintained for future equipment as shown on the Contract Drawings. CONTRACTOR shall submit to the ENGINEER for approval a detailed layout of all equipment as a whole as part of the shop drawing submittal for approval.

1.06 SUBSTANTIAL COMPLETION

- A. Substantially complete the scope of work described in Part 1.02 above, but not limited to, and as described in the Contract Documents including specified testing, training of Owner's personnel, and other preparations necessary for Owner's occupancy or use.
- B. Certificates of Substantial Completion will be executed prior to Owner occupancy. Such certificate of Substantial Completion will describe the portion of the Work to be occupied by OWNER, items that may be incomplete or defective, date of occupancy by OWNER, and other information required by OWNER and CONTRACTOR.
- C. After Owner occupancy, allow access for Owner's personnel, access for others authorized by Owner, and Owner operation of equipment and systems.
- D. Prior to such occupancy or use, provide written notice to OWNER indicating work that remains to be performed in occupied areas.
- E. When OWNER's use of occupied facilities reveal defective work, correct defects.
- F. No partial acceptance of the Work will be made and no acceptance other than the final acceptance of the completed Work will be made except for those portions of Work designated for early occupancy by OWNER.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01140

WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for sequencing and scheduling the Work affected by existing site and facility, work restrictions, and coordination between construction operations and plant operations.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01010 - Summary of Work.

1.02 SUBMITTALS

- A. Baseline Schedule with MOP tasks.
- B. Method of Procedure (MOP) Form.

1.03 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. Wastewater projects:
 - 1. The Westside Regional Water Reclamation Facility is the City of Daytona Beach's one of the two water reclamation facilities for treating domestic wastewater prior to discharging to either the public access reuse system or to the Halifax River. Impairing the operational capabilities of this treatment plant will result in serious environmental damage and monetary fines.
 - 2. Conduct work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
 - 3. The status of the treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit.
- B. Work sequence and constraints:
 - 1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.

2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with National Pollutant Discharge Elimination System permit requirements.

1.04 SHUTDOWN AND CONSTRUCTION CONSTRAINTS

A. General shutdown constraints:

1. Execute the Work while the existing facility is in operation.
2. Some activities may be accomplished without a shutdown.
3. Apply to activities of construction regardless of process or work area.
4. Activities that disrupt plant or utilities operations must comply with these shutdown constraints.
5. Organize work to be completed in a minimum number of shutdowns.
6. Provide thorough advanced planning, including having required equipment, materials, and labor on hand at time of shutdown.
7. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
8. Final determination of the permitting of shutdowns will be the sole judgment of the Owner's representative (Plant Superintendent).
9. Owner's representative (Plant Superintendent) maintains the ability to abort on the day of the scheduled shutdown.

B. General maximum plant flow work limitations:

1. Activities that disrupt plant operations are prohibited during the following flow conditions, unless otherwise approved in writing by the Engineer and Owner's representative (Plant Superintendent).
 - a. Flow condition: Maximum day or maximum load conditions during certain times of the year as determined by the Owner's representative (Plant Superintendent).

C. Unit process availability work limitations:

1. Shutdowns and tie-ins or other activities that disrupt plant operations are prohibited unless the following unit process availability conditions exist and unless otherwise approved in writing by the Engineer and the Plant Superintendent.
2. At a minimum, the following facilities must be in service in order to proceed with a scheduled shutdown.
 - a. Complete Plant headworks.
 - b. One set of three clarifiers and RAS/WAS pump station.
 - c. One entire 5-stage Bardenpho Treatment Train (all five stages).
 - d. ABW Filtration system.
 - e. UV Disinfection system.
 - f. Plant Effluent Pumping system.
 - g. Biosolids Dewatering System.

D. Shutdown activities:

1. Scheduling:
 - a. Coordinate with Plant Superintendent.
2. Unplanned shutdowns due to emergencies are not indicated in this Section.

- E. Process area construction constraints:
 - 1. The following sequences and constraints shall be observed while working in and around each of the following process areas:
 - a. Existing Secondary Clarifiers, Return Activated Sludge and Waste Activated Sludge pumping and dewatering of waste activated sludge.
 - b. Existing on-line 5-Stage Bardenpho Train.
 - c. Existing ABW filtration system.
 - d. Existing UV disinfection system.
 - e. Material hauling operations:
 - 1) Contractor shall comply with restrictions regarding Contractor's use of site and premises as specified in Section 01010.

1.05 METHOD OF PROCEDURE (MOP)

- A. MOP Instructions: See Attachment No. 1.
- B. Prepare MOP for the following conditions:
 - 1. Shutdowns, diversions, and tie-ins to the existing facility.
 - 2. Process start-up activities.
 - 3. Power interruption and tie-ins.
 - 4. Switch over between temporary and permanent facilities, equipment, piping, and electrical and instrumentation systems.
 - 5. Process constraints requiring interruption of operating processes or utilities.
- C. Other Work not specifically listed may require MOPs as determined necessary by the Contractor, Owner, or Engineer.
- D. Submit Baseline Schedule with proposed MOPs.
- E. Submit MOP Log at construction progress meetings.
- F. No consideration will be given to claims of additional time and cost associated to preparing MOPs required by the Owner and Engineer to complete this work in a manner that facilitates proper operation of the facility and compliance with effluent discharge criteria.
- G. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.

1.06 COMPLIANCE WITH NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT

- A. The existing facility is operating under the terms of a National Pollutant Discharge Elimination System permit issued by the Florida Department of Environmental Protection (FDEP). This permit specifies the water quality limits that the plant must meet prior to discharge of effluent. A copy of the existing permit is on file for review at the Westside Regional WRF.
- B. Perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.
- C. Bear the cost of penalties imposed on the Owner for discharge violations caused by actions of the Contractor.

1.07 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES

- A. Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
 - 1. Electrical power including transformers, distribution wiring, and VFDs.
 - 2. All treatment unit processes including:
 - a. Plant influent raw wastewater conveying pipelines.
 - b. Plant headworks including screens and grit removal system.
 - c. Flow distribution box No. 1 upstream of the Bardenpho basins.
 - d. At any given time, one of the two 5-stage Bardenpho basins complete with all five stage – anaerobic, 1st anoxic, aerobic, 2nd anoxic and reaeration should be operating with no limitations. Please coordinate with Plant Superintendent.
 - e. At any given time, one set of the three secondary clarifiers (either Clarifiers 1, 2, and 3; or 4, 5, and 6) should be operational with no limitations.
 - f. At any given time, the ability to pump return activated sludge and waste activated sludge to the respective treatment processes with no limitations including associated piping.
 - g. At any given time, the ability to dewater the waste activated sludge using the existing four belt filters presses with no limitations.
 - h. Existing automatic backwash (ABW) filters or new deep bed sand filters and UV disinfection system.
 - i. Existing high service pump station, reclaimed water storage tank and associated reuse pump station.
 - 3. Laboratory facilities.
 - 4. Office, toilets, and washrooms.
 - 5. Fencing and gates.
 - 6. Lighting.
 - 7. Heating, ventilation, and air conditioning.
 - 8. Instrumentation, meters, controls, and telemetry equipment.
 - 9. Safety equipment and features.
 - 10. Parking for City employees and vehicles required for operation and maintenance of the Westside Regional WRF.
 - 11. Storm drainage.
- B. Conduct the Work and provide temporary facilities required to keep the existing plant continuously operational.
- C. Do not remove or demolish existing facilities required to keep the existing plant operational at the capacities specified until the existing facilities are replaced by temporary, new, or upgraded facilities or equipment.
 - 1. Test replacement facilities to demonstrate operational success prior to removing or demolishing existing facilities.

1.08 OPERATIONS AND MAINTENANCE ACCESS

- A. Provide safe, continuous access to process control equipment for plant operations personnel.
- B. Provide access on 1-hour advance notice to process control equipment for plant maintenance personnel and associated maintenance equipment.

- C. This does not include emergencies as defined by the Owner's representative (Plant Superintendent).

1.09 UTILITIES

- A. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.
- B. New yard utilities were designed using existing facility drawings.
 - 1. Field verification of utilities locations was not performed during design.
 - 2. Services crossed or located nearby by new yard utilities may require relocation and possible shutdowns.
 - 3. Pipe alignments as indicated on the Drawings.

1.10 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.
- B. Obtain construction schedules from subcontractors and suppliers, and assume responsibility for correctness.
- C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

1.11 WORK BY OTHERS

- A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.12 WORK SEQUENCE

- A. Provide a detailed work sequence to Engineer and Owner to review and approval before start of any work. In general the following work sequence is recommended.
 - 1. Sludge Dewatering Improvements
 - a. Remove and demolish existing equipment and various piping, conduits, odor control ducts, and panels on the first floor of the dewatering building as shown on the drawings.
 - b. Demolition of walls of the existing building on the first floor and installation of roll-up doors as shown on the drawings.
 - c. Construct a new climate controlled electrical room on 1st floor as shown on the drawings.
 - d. Install new MCC-3, and control panels.
 - e. Fill all recessed areas on the 1st floor with concrete as indicated on the drawings
 - f. Cut the existing floor for new floor drains/trenches as shown on the drawings.
 - g. Install all new yard piping, tie-in as shown on the drawings.
 - h. Pour new BFP containment area curb walls and new BFP supports per approved shop drawings for the new BFPs.
 - i. Install new horizontal conveyor.
 - j. Install new 3-belt BFPs and associated washwater pumps and piping (inside the dewatering building) as show on the drawings.
 - k. Install new polymer blending units and all associated piping.

- l. Install new sludge feed piping to each BFP from the existing sludge feed pumps as shown on the drawings. Install a polymer injection ring and mixing valve on the discharge of each sludge feed pump downstream of the magnetic flow-meter. Coordinate and follow directions of BFP manufacturer on the type and location of the polymer injection and mixing valve as desired. Install new polymer solution piping to the polymer injection ring.
- m. Construct new polymer tote storage area as shown on the drawings.
- n. Integrate BFP and conveyor programming into the new BFP Master Control Panel (PCP-DW).
- o. Set up a rental 2.2 meter 3-belt trailer-mounted BFP with a feed pump, polymer storage and feed, washwater pump and loading conveyor to allow for taking the existing dewatering operation offline and be available for the following construction modifications.
 - 1) Coordinate with the Owner a suitable location for parking of the conveyor and coordinating the feed sludge, washwater, filtrate water, cake unloading, power/electrical and other ancillary equipment to operate the trailer mounted BFP while modifications are done to the bring the new dewatering system online.
 - 2) Demolish the existing truck unloading conveyor
 - 3) Install new inclined conveyor and supports and associated control panel.
 - 4) Install new truck unloading conveyor and associated control panel.
 - 5) Paint walls of the new belt press room on the first floor.
 - 6) Perform functional test, followed by start-up and performance testing on the new BFPs, polymer, and conveyor system.
 - 7) After successful start-up of the new BFPs, remove the trailer and associated utilities and other ancillary equipment and clean the site as necessary.
- p. Remove and demolish all equipment associated with the four existing BFPs including hydraulic pump units, control panels, and alarm panel as shown on the drawings, located on the second floor of the existing dewatering building.
- q. Remove and demolish existing MCC-3 and other electrical items located on the second floor of the existing building as shown on the drawings.
- r. Demolish existing BFP containment area, and BFP supports, odor control piping, sludge piping, panels etc. on the second floor as shown on the drawings.
- s. Remove and demolish both inclined screw conveyors and both horizontal screw conveyors.
- t. Remove and demolish three conveyor control panels: two on the first floor of the dewatering building in the truck loading area and one in the second floor BFP room by the mezzanine stairs.
- u. Remove and demolish all odor control piping on the second floor of the dewatering building serving the BFP room. Patch all first floor ceiling penetrations. Cut and cap north wall penetrations just inside the dewatering building
- v. Remove and demolish all 4 inch sludge feed piping from the BFP room. Patch floor penetrations. Remove and demolish the sludge feed piping which runs along the first floor ceiling and patch any floor penetrations.
- w. Remove and demolish washwater piping back to floor penetration as seen in the Drawings.

- x. Remove and demolish all PVC drain piping running along the first floor ceiling which is associated with the existing BFP room floor drains. Patch five floor penetrations in the existing BFP containment pit area.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

Attachment No. 1
“Method of Procedure” (MOP)
Instructions and Forms

Definition and Purpose

“Method of Procedure” (MOP) is a detailed document submitted by the Contractor to request process shutdown(s), utility tie-in(s), work in areas that may risk unanticipated outages, or flow diversions to accommodate site construction activities during a project. Such activities may include (but are not limited to) new tie-ins to utilities or structures, mechanical modifications to process piping or equipment, demolition, bulkhead installation, and cleaning processes.

The MOP provides a detailed plan to the Owner and Engineer that describes specific aspects of the work including purpose, time of execution, and anticipated impacts on treatment processes. The MOP also includes contingency measures and provisions for rapid closure in the event that shutdown or work progress difficulties are encountered. Information from relevant trades associated with the requested shutdown, diversion, or tie-in is also included.

The Owner should use the information within the MOP to define operational procedures and methods to safely and successfully assist the Contractor.

MOP Process Summary

WHO	STEP	TIMING
Contractor	1. Identify MOPs needed on MOP Log and Baseline Schedule.	7 days prior to Preconstruction Scheduling Meeting
Contractor, and Owner	2. Pre-MOP Meeting.	More than 28 days prior to work
Contractor	3. Submits MOP.	No later than 28 days prior to work
Owner	4. Reviews MOP.	
Owner	5. MOP finalized.	7 days prior to work
Contractor	6. Complete Readiness Checklist.	5 days prior to work
Contractor	7. Complete Safety Checklist.	Just prior to commencing work
Contractor	8. Complete Work.	
Contractor	9. Update MOP Log and Progress Schedules.	Monthly

MOP Process Detail

STEP 1. Identifies MOPs needed on MOP Log and Baseline Schedule.

Contractor submits a preliminary list of anticipated project MOPs on MOP Log. MOPs identified but not limited to those shutdowns, diversions, or tie-ins described in the Contract Documents. Incorporate MOPs as tasks in Baseline Schedule. Date scheduled MOPs to coincide with the appropriate construction activities.

STEP 2. Pre-MOP Meeting.

Contractor requests a Pre-MOP Meeting with the Owner to discuss the nature of the shutdown, diversion, or tie-in, and to gather the information necessary to complete the MOP Form. The pre-MOP meeting may be waived by the Owner if the work is deemed to be minor.

STEP 3. Submits MOP.

Contractor completes the MOP Form and submit 3 copies for approval to the Owner's Project Manager (OPM).

STEP 4. Reviews MOP.

OPM distributes MOP Form for review by the Owner's Construction Coordinator, O&M Representative, and Engineer's Project Representative. Review MOP Form for completeness, accuracy, compliance with both the construction schedule, constraints defined in contract documents, and to ensure that the requested work does not negatively impact plant operations or other concurrent project activities. Additional information may be requested to better understand the nature of and method for completing the Work.

STEP 5. MOP finalized.

Once the MOP is agreed to by all parties, the MOP will be finalized by signature. Copies are distributed to the Owner, Engineer, and Contractor.

STEP 6. Complete Readiness Checklist.

Contractor verifies everything is ready for the work.

STEP 7. Complete Safety Checklist.

Contractor ensures safety.

STEP 8. Complete work.

Contractor complete work.

STEP 9. Update MOP Log and Progress Schedules.

Contractor updates MOP Log weekly and distributes at the regularly scheduled construction progress meetings.

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SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Procedures for measurement and payment of Work performed on a unit price basis as outlined on the Bid Form.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Bid Form.
 - b. General Conditions

1.02 MEASUREMENT OF QUANTITIES

- A. Measurement of lump sum items shall be based on the percent of actual completion as determined by the Contractor and agreed upon by the Engineer.
- B. Where applicable, work paid at a unit price times number of units measured will be measured by Engineer/Owner in accordance with United States Standard Measures.
- C. Measurement of volumes shall be the actual "as-built" volume pertinent to payment items.
- D. Payment will start only after material is delivered to the project site and verified by the Construction Manager.

1.03 PAY ITEMS

- A. General:
 - 1. The pay items are included in Bid Form.
 - 2. Payment procedures as specified in General Conditions.
- B. Item 1: Construction of biosolids dewatering system improvements.
 - 1. Work includes:
 - a. Performance, payment, and other bonds and insurances provided as specified in General Conditions, and all administrative costs associated with maintaining the necessary coverage as described in the Contract Documents.

- b. For mobilization, work as specified in this item shall consist of work preparatory to actual construction at the site. It shall include, but not be limited to, movement of personnel, equipment, supplies, and incidentals to the project site, and for the establishment of temporary offices, buildings, safety equipment and first aid supplies, sanitary and other facilities as required by these Specifications, the submittal of all required insurance certificates and bonds, posting of all OSHA required notices and establishment of safety programs at the jobsite, any additional requirements of the Supplementary Conditions, and state and local laws and regulations. The costs of any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall be included in this item. Also included in this item will be all costs associated with meetings and coordination with the Owner and Engineer for the purpose of discussing project progress or coordination of tie-in locations. Demobilization shall include but not be limited to the following: Removal of all temporary construction facilities, removal of all equipment and excess materials, and cleanup and restoration of the site to conditions existing prior to construction.
 - c. Provide signage in accordance with EPA's Public Awareness standard signage requirements.
 - d. Performing a certified site survey of the construction area as noted on the Civil Drawings before any work is commenced.
 - e. Supply, installation, and successful start-up of three belt filter presses, associated existing sludge feed pumps, new wash water pumps, new polymer blending units, new cake conveyance system, all piping, valves and appurtenances, and associated controls. Includes all concrete supports and modifications to the existing dewatering building floor and building.
 - f. Construction of a new electrical room, with new electrical equipment, and necessary HVAC.
 - g. Demolition of existing equipment as shown on the drawings.
 - h. As specified in Contract specifications and Drawings.
 - i. Also includes supply of all spare parts to the Owner.
2. Measurement: Lump sum.
3. Payment:
- a. For bonds and insurance, payment will be made upon verification that the required Bonds and Insurances have been acquired. The Contractor shall submit an invoice substantiating the costs for the Bonds and Insurances within a regular pay request. The cumulative total shall not exceed the Lump Sum Pay Item amount
 - b. For mobilization and demobilization, payment will be made as specified in General Conditions. The cumulative total shall not exceed the Lump Sum Pay Item amount. No additional payment will be made for demobilization and remobilization due to shutdowns, suspensions of Work or for other mobilization activities
 - c. For the rest of the work, payment will be based on percentage of work completed during the pay period at the time of the pay application to the nearest 5 percent complete as mutually agreed to by the Contractor and Construction Manager; the cumulative total shall not exceed the Lump Sum Bid Item price.

- C. Item 2: Mobile (trailer mounted) temporary complete Biosolids dewatering system:
1. Work Includes:
 - a. Provide a temporary, mobile (trailer mounted), biosolids dewatering system complete with a dewatering equipment such as a belt filter press or screw press or high solids centrifuge, a sludge feed pump, polymer storage and feed equipment, washwater pump and loading conveyor to allow taking the existing dewatering operation off-line for a period of time during construction of the dewatering improvements. The plug-and-play mobile biosolids dewatering system should be capable of handling a minimum of 300 gallons per minute of waste activated sludge at 0.6% total suspended solids concentration and be able to produce a dewatered cake of minimum 14% cake solids at all times. The trailer should be equipped with all necessary electrical and instrumentation and controls and ready for hook-up. Include 100-ft long 6-inch hoses for connection to sludge, water and drain connections. Include trailer set-up, test and start-up complete with all mobilization and demobilization services.
 - b. Measurement: Rental Cost for the trailer per month.
 - c. Payment: Payment will be based on rental cost per month for every month the trailer is utilized for temporary dewatering needs at the facility and as confirmed by the City's Construction Manager, at the Bid Item Unit Price per month.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

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METHOD OF PROCEDURE (MOP) FORM

Owner: _____ Date: _____
 Contractor: _____ Carollo Project No.: _____
 Project Name: _____ Submittal No.: _____
 Submittal Title: _____ Spec/Dwg. Reference: _____

MOP #	Task Title (Provide <10 word title):	Submittal Date: (No later than 28 days prior to work)
-------	--------------------------------------	---

SCHEDULE OF WORK ACTIVITY START: (Date/Time) _____ END: (Date/Time) _____

REQUESTOR: _____

PRIMARY POINT OF CONTACT: _____ PHONE/PAGER: _____

SECONDARY POINT OF CONTACT: _____ PHONE/PAGER: _____

NOTIFY Control Room, Phone Security, Phone

BUILDING: _____ LOCATION OF WORK FLOOR/LEVEL: _____

DESCRIPTION OF WORK: (Provide sufficient details on process isolation, work sequencing, and safety (i.e., control of significant hazards unique to the work) to demonstrate an understanding of the work and how it will be completed within the constraints, and its impact on the processes and facility.)

Task Summary: _____

Processes Affected: _____

Trades Affected: _____

WORK PLAN:

Work Sequencing: _____

Process Isolation: _____

Spill Prevention Plan: _____

Contingency Plans: _____

CRITICAL EQUIPMENT/TOOLS: (pumps and discharge hoses with correct fittings, blind flanges and pipe plugs, no-hub fittings, properly sized electrical service components, generators, portable lighting, chlorine for potable water pipe breaks, etc.)

<input type="checkbox"/>	Acoustic Ceiling/or Walls Access	<input type="checkbox"/>	Excavation Permit	<input type="checkbox"/>	Lock Out/Tag Out
<input type="checkbox"/>	Chemical Use Approval	<input type="checkbox"/>	Fire Sprinkler Impairment	<input type="checkbox"/>	Life Safety Systems
<input type="checkbox"/>	Confined Space Permit	<input type="checkbox"/>	Flammable Materials	<input type="checkbox"/>	Roof Protocol
<input type="checkbox"/>	Critical Lift Plan	<input type="checkbox"/>	Flush / Discharge	<input type="checkbox"/>	Work After Dark
<input type="checkbox"/>	Energized Electrical Work	<input type="checkbox"/>	High Pressure Test	<input type="checkbox"/>	
<input type="checkbox"/>	Elect. Panel Schedules	<input type="checkbox"/>	Hot Work/Open Flame	<input type="checkbox"/>	

EXISTING SERVICE(S) AT RISK:

<input type="checkbox"/>	Breathing Air	<input type="checkbox"/>	Elect Normal	<input type="checkbox"/>	Process Access	<input type="checkbox"/>	Telephones
<input type="checkbox"/>	Chemical Distribution	<input type="checkbox"/>	Fire Protection	<input type="checkbox"/>	Safety Showers	<input type="checkbox"/>	UPS
<input type="checkbox"/>	City Water	<input type="checkbox"/>	HVAC	<input type="checkbox"/>	SCADA	<input type="checkbox"/>	VAX/DATA
<input type="checkbox"/>	Communication	<input type="checkbox"/>	Inert Gas	<input type="checkbox"/>	Security	<input type="checkbox"/>	
<input type="checkbox"/>	Domestic Drain	<input type="checkbox"/>	Instrument - Air	<input type="checkbox"/>	Solvent Drain	<input type="checkbox"/>	
<input type="checkbox"/>	Elect-Bus Duct	<input type="checkbox"/>	Life Safety System	<input type="checkbox"/>	Specialty Gases	<input type="checkbox"/>	
<input type="checkbox"/>	Elect Emergency	<input type="checkbox"/>	Natural Gas	<input type="checkbox"/>	Storm Drain	<input type="checkbox"/>	

REVIEWER'S INSTRUCTIONS / COMMENTS: _____

PREJOB BRIEFING MUST BE COMPLETED PRIOR TO COMMENCING WORK:

	Full Name (printed)	Signature	Phone	Date
Submitted By				
System Owner				
Reviewer (if needed)				
Reviewer (if needed)				

Reviewer (if needed)				
Reviewer (if needed)				

READINESS CHECKLIST
(5 days prior to work)

Checklist provided as a guide but is not all inclusive.

1. Confirm all parts and materials are on site: _____
2. Review work plan: _____
3. Review contingency plan: _____

SAFETY CHECKLIST
(Just prior to commencing work)

Checklist provided as a guide but is not all inclusive.

1. Location awareness:
 - a. Emergency exits: _____
 - b. Emergency shower and eyewash: _____
 - c. Telephones and phone numbers: _____
 - d. Shut-off valve: _____
 - e. Electrical disconnects: _____
2. Inspect work area:
 - a. Take time to survey the area you are working in. Ensure that what you want to do will work. Do you have enough clearance? Is your footing secure? Do you have adequate lighting and ventilation? Are surrounding utilities out of the way for you to perform your work?
3. Safety Data Sheets
4. MSDS (Material Safety Data Sheets):
 - a. Understand the chemicals and substances in the area you are working in by reading the MSDS.
5. Lockout/Tagout Procedure:
 - a. Lockout/tagout energy sources before beginning work.
 - b. Make sure all valves associated with the work are locked out and tagged out on each side of the penetration.
 - c. Make sure the lines are depressurized.
6. Overhead work:
 - a. Use appropriate personal protective equipment; i.e., safety harness, lifeline, etc.
 - b. Select appropriate tie-off points; i.e., structurally adequate, not a pipe or conduit, etc.
 - c. Spotter assigned and in position.
 - d. Pipe rack access; i.e., check design capacity, protective decking or scaffolding in place, exposed valves or electrical switches identified and protected.
7. Safety equipment:
 - a. Shepherd's hook.
 - b. ARC flash protection.
 - c. Fire extinguisher.
 - d. Other:
8. Accidents:
 - a. Should accidents occur, do not shut off, and do not attempt to correct the situation, unless you are absolutely positive that your action will correct the problem and not adversely affect other people or equipment.
9. Review start-up documents:
 - a. In the event the system is shutdown, the Control Center should have a working knowledge of the start-up procedures in order to deal effectively with unforeseen events.
10. Evacuation procedures:
 - a. Do not obstruct evacuation routes.
 - b. Take time to survey the area for evacuation routes.
11. Contractor and subcontractors and their representatives must comply with all City of Daytona Beach safety policies and relevant OSHA requirements.

Method of Procedure (MOP) Log
Sample

MOP Number	Task Title	Date Requested	Date Approved	Date Work Planned	Work Completed (yes/no)
001					
002					
003					

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SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for preparation, format, and submittal of Schedule of Values.
- B. Related section:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01324B - Progress Schedules and Reports.
 - b. Section 16050 - Common Work Results for Electrical.

1.02 PREPARATION

- A. Prepare Schedule of Values identifying costs of Major Items of Work and other costs shown in sample included at end of this Section.
- B. Divide the work into following major items of work:
 - 1. Mobilization.
 - 2. Demobilization.
 - 3. As-Built Site Survey.
 - 4. Sludge Dewatering Facility Improvements.
 - 5. Electrical and Instrumentation Controls.
 - 6. Demolition items.
- C. Assign prices to Major Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Major Item of Work.

1.03 SUBMITTALS

- A. Submit preliminary schedule of values.
- B. Submit corrected schedule of values within 10 days upon receipt of reviewed Schedule of Values, but no later than 10 days prior to anticipated submittal of first Application for Payment.
- C. Upon request, support prices with data which will substantiate their correctness.

- D. If activities are added or removed from the Progress Schedule revise the Schedule of Values and resubmit.

1.04 SAMPLE SCHEDULE OF VALUES

- A. Following is an acceptable form for Schedule of Values:

SUGGESTED SCHEDULE OF VALUES		
NO.	DESCRIPTION OF ITEM	COST
1.	Mobilization.	
2	Demolition Items <ul style="list-style-type: none"> • Existing Belt Filter Presses (BFPs) including four (4) hydraulic pump units, four (4) control panels, and one (1) alarm panel. • Existing cake conveyor system including five (5) screw conveyors and three (3) control panels. • MCC-3 • BFP containment area including BFP supports, and curb walls. • BFP room mezzanine stairs. • BFP room doors and frames. • All first and second floor odor control piping within the dewatering building only. • Second floor BFP area drain piping suspended beneath the first floor ceiling. • Portions of plant service water and BFP sludge feed piping as indicated on the drawings. 	
3.	Dewatering facility piping including all below grade year and above grade piping, valves, appurtenances	
4.	Electrical major items of work. <ul style="list-style-type: none"> • MCC-3 • BFP and Conveyor control panels. • Conduit & Wire 	
5.	Major Equipment (Supply, Installation, Start-up and Testing) <ul style="list-style-type: none"> • 3-belt BFPs • Washwater pumps • Cake Conveyor System • Polymer blending units 	
6.	Structruals <ul style="list-style-type: none"> • BFP containment area support columns • BFP containment area 	

SUGGESTED SCHEDULE OF VALUES		
	<ul style="list-style-type: none"> • Second floor mezzanine stairs. • Door and frames. 	
8.	Instrumentation and Control major items of work. <ul style="list-style-type: none"> • Programming BFP and Conveyor control logic into existing PLC PCP2 • Programming & Testing and integration with Plant SCADA • Field Instruments (supplied by Contractor) 	
9.	Start-up, testing and Training	
10.	Demobilization	
11.	Miscellaneous work items and other prices not included in previous items and necessary to complete the Work.	
	TOTAL LUMP SUM BID	

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01294

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Procedures for preparation and submittal of Applications for Payment.

1.02 FORMAT

- A. Develop satisfactory spreadsheet-type form generated by downloading cost data from the Schedule of Values.
- B. Fill in information required on form.
- C. When Change Orders are executed, add Change Orders at end of listing of scheduled activities:
 - 1. Identify change order by number and description.
 - 2. Provide cost of change order in appropriate column.
- D. After completing, submit Application for Payment.
- E. Owner will review application for accuracy.
- F. Execute application with signature of responsible officer of Contractor firm.

1.03 SUBSTANTIATING DATA

- A. Provide Substantiating Data with cover letter identifying:
 - 1. Project.
 - 2. Application number and date.
 - 3. Detailed list of enclosures.
 - 4. For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products.
 - 5. Submit "certified" payroll.

1.04 SUBMITTALS

- A. Submit 5 copies of Application for Payment and Substantiating Data with cover letter.

1.05 PAYMENT REQUESTS

- A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity. The City will provide summary cover sheet for pay requests.

- B. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.
- C. Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, and the value of work completed for both the payment period and job to date.
- D. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.
- E. Submit progress payment requests at progress meetings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01312

PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
 - 1. Qualifications of Meeting Participants.
 - 2. Preconstruction Conference.
 - 3. Progress Meetings.
 - 4. Pre-Installation Meetings.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 16050 - Basic Electrical Materials and Methods.
 - b. Section 17000 - Instrumentation and Controls.

1.02 QUALIFICATIONS OF MEETING PARTICIPANTS

- A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.03 PRECONSTRUCTION CONFERENCE

- A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, Engineer on behalf of Owner, will arrange preconstruction conference in convenient place for most persons invited, in accordance with the General Conditions.

- B. Attending Preconstruction Conference: Contractor's Project Manager, Quality/Safety Manager, Superintendent, Owner's representative (Plant Superintendent), Engineer's Representative, representatives of utilities, major subcontractors and others involved in performance of the Work, and others necessary to agenda.

- C. Engineer's Representative will preside at conference.

- D. Purpose of conference: To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.
- E. Engineer will prepare and distribute agenda in advance on the meeting.
- F. Engineer's representative and Contractor will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.04 PROGRESS MEETINGS

The Contractor will be responsible for the following:

- A. Conduct progress meetings at least once a month in Contractor's field office, Owner's office, or other mutually agreed upon place.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Require attendance of Contractor's representatives, Engineer's representative, and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
- D. Invite Owner's representative (Plant Superintendent), utility companies when the Work affects their interests, and others necessary to agenda.
- E. Complete and bring Application for Payment and Progress Schedule to progress meeting.
- F. Prepare and distribute agenda.
- G. Preside at meetings.
- H. Purpose of progress meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
- I. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
- J. Verify:
 - 1. Actual start and finish dates of completed activities since last progress meeting.
 - 2. Durations and progress of activities not completed.
 - 3. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
 - 4. Percentage completion of items on Application for Payment.
 - 5. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.

- K. Discuss potential problems which may impede scheduled progress and corrective measures.
- L. Both Contractor and Engineer's representative will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.05 PRE-INSTALLATION MEETINGS

The Contractor will be responsible for the following:

- A. General: Meet with manufacturers and installers of major units of construction which require coordination between subcontractors.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Schedule meeting at least 7 days in advance of installation.
- D. Conduct meetings in Contractor's field office or other mutually agreed upon place.
- E. Require attendance of Contractor representatives, Engineer's representatives, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.
- F. Invite Owner's representative (Plant Superintendent).
- G. Preside at meetings.
- H. Record minutes of meeting and distribute copies of minutes within 3 days of meeting to participants and interested parties.

1.06 SCHEDULE UPDATE MEETINGS

- A. Contractor will schedule meetings throughout progress of the Work at maximum monthly intervals.
- B. Contractor will make arrangements for meetings; will prepare agenda with copies for participants, and preside at meetings.
- C. Attendance required: Owner, Engineer's representative, Contractor's Project Manager, General Superintendent, project scheduler, major subcontractors, and suppliers as appropriate to agenda topics for each meetings.
- D. Agenda:
 - 1. Review Monthly Schedule, (Actual Progress and Variance).
 - a. "Activities Started/Completed" this period.
 - b. "Activities Started/Completed" "Variance" Baseline vs. current.
 - c. "Added/Deleted Activities".
 - d. "Revised Activity Descriptions".
 - e. Any significant Proposed Logic Changes.
 - 2. Review milestone "Substantial Completion" Schedule.
 - a. "Critical" Activities - "Critical Area, Float and Vital Statistics".

3. Review "Cumulative and Monthly Costs" graph.
 4. Review "Budgeted Cost" indicating the Current Project Budgeted Cost.
- E. Both Contractor and Engineer's representative will record changes for update and distribute electronic copies within 7 calendar days after meeting to participants and interested parties.

1.07 QUALITY CONTROL MEETINGS

- A. Contractor will schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
- B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
- C. Attendance Required: Contractor's Project Manager and staff, Contractor's Quality Control Manager and staff, and Engineer's Representative.
- D. Agenda:
1. Review minutes of previous meetings.
 2. Review of Work progress and schedule.
 3. Review of out-of-compliance inspection or test results.
 4. Field observations, problems, and decisions.
 5. Review of offsite fabrication and delivery schedules.
 6. Planned progress during succeeding work period.
 7. Coordination of required inspections and tests.
 8. Review 6-week schedule report with upcoming inspections and special tests.
 9. Maintenance of quality and work standards.
 10. Other business relating to Work.
- E. Both Contractor and Engineer's representative will record minutes and distribute electronic copies within 5 calendar days after meeting to participants, and those affected by decisions made.

1.08 PRESHUTDOWN MEETINGS

- A. Contractor will follow Owner's standard Construction Method of Procedure (MOP). See Appendix A of Section 01140 for MOP format.
- B. All short-term and longer-term shutdowns and other tie-ins that require an Owner approved MOP also require a pre-shutdown meeting at Project site prior to commencing shutdown for tie-in or modification of specific plant systems.
- C. Require attendance of parties directly affecting, or affected by shutdown, including Engineer's representative, specific work crews, Owner's representative (Plant Superintendent).
- D. Contractor will notify Owner's representative (Plant Superintendent) and Engineer's representative 7 calendar days in advance of meeting date.

- E. Contractor will prepare agenda and preside at meeting:
 - 1. Review accepted MOP including conditions of shutdown, preparation, and installation procedures.
 - 2. Review timelines and sequences.
 - 3. Review responsibilities.
 - 4. Review dry run plan and schedule, as necessary.
 - 5. Review coordination with related work.
- F. Both Contractor and Engineer's representative will record minutes and distribute copies within 5 calendar days after meeting and prior to scheduled shutdown to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.09 PRE-PROCESS START-UP MEETINGS

- A. All processes and equipment that requires testing and process start-up also requires a pre-startup meeting at Project site before commencing process start-up of specific plant systems.
- B. Require attendance of parties directly affecting, or affected by process start-up and testing, including Engineer's representative, specific work crews, Owner's representative (Plant Superintendent).
- C. Contractor will notify Owner's representative (Plant Superintendent) and Engineer's representative 7 calendar days in advance of meeting date.
- D. Contractor will prepare agenda and preside at meeting:
 - 1. Review accepted MOP including conditions of process start-up and testing, preparation, and installation procedures.
 - 2. Review timelines and sequences.
 - 3. Review responsibilities.
 - 4. Review dry run plan and schedule, as necessary.
 - 5. Review coordination with related work.
- E. Both Contractor and Engineer's representative will record minutes and distribute electronic copies within 5 calendar days after meeting and prior to scheduled process start-up to participants, with copies to Engineer, Owner, and those affected by decisions made.
- F. Contractor will follow Owner's standard Construction Method of Procedure (MOP). See Appendix A of Section 01140 for MOP format.

1.10 ELECTRICAL AND INSTRUMENTATION COORDINATION MEETINGS

- A. Contractor shall be responsible for conducting the following:
 - 1. Electrical Meetings:
 - a. Pre-submittal review meeting as specified in Section 16050.
 - b. Electrical System Study Meetings as specified in Division 16.
 - c. Other meetings as required and as otherwise specified.
 - 2. Instrumentation and Control Meetings:
 - a. Pre-Submittal Conference as specified in Section 17000.
 - b. System Configuration Meetings as specified in Section 17000.

- c. Graphics Meetings as specified in Division 17.
- d. Report Meetings as specified in Division 17.
- e. Other meetings as required and as otherwise specified.

1.11 CLOSE-OUT MEETING

- A. Contractor will schedule close-out meeting.
- B. Contractor will make arrangements for meeting, prepare agenda with copies for participants, and preside at meeting.
- C. Attendance required: Owner, Engineer's representative, Contractor's Project Manager, Superintendent.
- D. Agenda:
 - 1. Review punchlist completion.
 - 2. Transfer of record documents.
 - 3. Finalize payment.
- E. Engineer's representative will record minutes and within 5 calendar days after meeting distribute copies to participants.

1.12 POST CONSTRUCTION MEETING

- A. Meet with and inspect the Work 11 months after date of Substantial Completion with Owner and Engineer's representative.
- B. Owner will arrange meeting at least 7 days before meeting.
- C. Meet in Owner's office or other mutually agreed upon place.
- D. Inspect the Work and draft list of items to be completed or corrected.
- E. Review service and maintenance contracts, and take appropriate corrective action when necessary.
- F. Complete or correct defective work and extend correction period accordingly.
- G. Require attendance of Contractor's Project Manager, or Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01324B

PROGRESS SCHEDULES AND REPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, contract time adjustments, and payment requests, including the following:
1. Preliminary Schedule.
 2. Baseline Schedule.
 3. Monthly Schedule Updates.
 4. Weekly Summary Schedule.
 5. Submittal Schedule.
 6. Manpower Schedule.
 7. Equipment Schedule.
 8. Commissioning and Process Start-up Schedule.
 9. As-built Schedule.
- B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. General Conditions.
 - b. Section 01292 - Schedule of Values.
 - c. Section 01294 - Applications for Payment.
 - d. Section 01756 - Testing, Training and Facility Start-up.

1.02 SCHEDULER

- A. Contractor shall designate, in writing and within 5 calendar days after Notice-to-Proceed, person responsible for preparation, maintenance, updating, and revision of all schedules.
- B. Qualifications of scheduler:
1. Authority to act on behalf of Contractor.
 2. 5 years verifiable experience in preparation of complex construction schedules for projects of similar value, size, and complexity.
 3. Knowledge of critical path method (CPM) scheduling utilizing latest version of Primavera P6 Professional.

- C. Owner in consultation with Engineer's representative reserves the right to disapprove scheduler when submitted by Contractor if not qualified. Owner reserves the right to remove scheduler from the project if found to be incompetent.

1.03 SCHEDULING FORMAT AND SOFTWARE

- A. Schedule format: Utilize CPM format.
- B. Prepare computerized schedule utilizing Primavera P6 Professional, most current version.
 - 1. Provide 1 licensed copy of the scheduling software to the Engineer's representative, registered in the Engineer's name, for the duration of the project.
 - 2. The provided copy of the software shall be a standalone version for installation on a standalone computer.

1.04 PRECONSTRUCTION SCHEDULING MEETING

- A. Contractor will conduct Preconstruction Scheduling Meeting with Contractor's Project Manager, General Superintendent, and scheduler within 7 calendar days after Notice-to-Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.
- B. At the meeting, review scheduling requirements. These include schedule preparation, reporting requirements, updates, revisions, and schedule delay analysis. Present schedule methodology, planned sequence of operations, and proposed activity coding structure.
- C. Coding structure:
 - 1. Submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule.
 - 2. A minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work.
 - 3. Submittal/Procurement/Construction and Responsibility/Subcontractor. Refer to network details and graphical output for listing of activity categories to be included in the schedule.
- D. Naming convention: Name schedule files with the year, month and day of the data date, revision identifier, and a description of the schedule.
 - 1. Example 1: 2014_07_30 rev 1 draft baseline schedule.xer.
 - 2. Example 2: 2014_09_30 rev 2 sep final update.xer.
- E. Filing: Post submitted files to EADOC document control system.

1.05 SCHEDULE PREPARATION

- A. Preparation and submittal of Progress Schedule represents Contractor's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause as specified in Document 00700, under Suspension of Work and Termination.
- B. Contractor's price covers all costs associated with the execution of the Work in accordance with the Progress Schedule.

- C. During preparation of the preliminary Progress Schedule, Engineer's representative will facilitate Contractor's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.
- D. Prepare schedule utilizing Precedence Diagramming Method (PDM).
- E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work. Coordinate holidays to be observed with the Owner's representative (Plant Superintendent), and incorporate them into the schedule as non-working days.
- F. Failure to include an activity required for execution of the Work does not excuse Contractor from completing the Work and portions thereof within specified times and at price specified in Agreement. Contract requirements are not waived by failure of Contractor to include required schedule constraints, sequences, or milestones in schedule. Contract requirements are not waived by Owner's acceptance of the schedule. In event of conflict between accepted schedule and Contract requirements, terms of Contract govern at all times, unless requirements are waived in writing by the Owner.
- G. Reference schedule to working days with beginning of Contract Time as Day "1."
- H. Contract float is for the mutual benefit of both Owner and Contractor. Changes to the project that can be accomplished within this available period of float may be made by Owner without extending the Contract time, by utilizing float. Time extensions will not be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, Contractor may utilize float to offset delays other than delays caused by Owner. Mutual use of float can continue until all available float shown by schedule has been utilized by either Owner or Contractor, or both. At that time, extensions of the Contract time will be granted by Owner for valid Owner-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by Contractor.
- I. Schedule logic: Assembled to show order in which Contractor proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and use of manpower, materials, and equipment. Form basis for assembly of schedule logic on the following criteria:
 - 1. Which activities must be completed before subsequent activities can be started?
 - 2. Which activities can be performed concurrently?
 - 3. Which activities must be started immediately following completed activities?
 - 4. What major facility, equipment or manpower restrictions are required for sequencing these activities?
- J. Non-sequestering of float: Pursuant to float sharing requirements of Contract, schedule submittals can be rejected for, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations or imposed dates.

- K. Interim milestone dates, operational constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, show them on schedule. Do not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.
- L. Schedule windows for Owner furnished, Contractor-installed equipment or materials: Immediately after Notice-to-Proceed, obtain from Engineer's representative anticipated delivery dates of Owner furnished equipment or materials. Show these dates in the schedule in same manner indicated by Engineer.
- M. Cost loading: All schedules:
 - 1. Only on-site construction activities.
 - 2. The sum total of all cost loaded activities equal the current value of the Contract, including change orders, at all times.
 - 3. Owner acceptance of the Baseline Schedule creates the Schedule of Values required as specified in Section 01292.
 - 4. Provide updated Schedule of Values as the monthly Payment Application as specified in Section 01292.
 - 5. Payments will not be made until updated Schedule of Values is accepted.

1.06 NETWORK DETAILS AND GRAPHICAL OUTPUT

- A. Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.
- B. Include for each activity, the description, activity number, estimated duration in working days, total float, and all activity relationship lines.
- C. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of one activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.
- D. Indicate the critical path for the project.
- E. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. Show the time period between the planned and Contract completion dates, if any, as an activity identified as project float unless a Change Order is issued to officially change the Contract completion date.
- F. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones.
- G. Include, in addition to construction activities:
 - 1. Submission dates and review periods for major equipment submittals, shoring submittals, and indicator pile program:
 - a. Shoring reviews: Allow 4-week review period for each shoring submittal.
 - b. Pile indicator program: Allow 3-week review period for analysis of program.
 - 2. Any activity by the Owner or the Engineer that may affect progress or required completion dates.

3. Equipment and long-lead material deliveries over 8 weeks.
 4. Approvals required by regulatory agencies or other third parties.
- H. Produce network diagram on 22-inch by 34-inch sheets with grid coordinate system on the border of all sheets utilizing alpha and numeric designations.
- I. Identify the execution of the following:
1. Mobilization.
 2. All required submittals and submittal review times showing 30 calendar day duration for such activities and equal amount of time for re-submittal reviews.
 3. Equipment and materials procurement/fabrication/delivery.
 4. Excavation.
 5. Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
 6. Shoring review, shoring materials procurement, shoring installation, and shoring removal.
 7. Backfill and compaction.
 8. Dewatering.
 9. Grading, subbase, base, paving, and curb and gutters.
 10. Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing, and patching.
 11. Tests for leakage of concrete structures intended to hold water.
 12. Metal fastenings, framing, structures, and fabrications.
 13. Doors and windows, including hardware and glazing.
 14. Finishes including coating and painting, flooring, ceiling, and wall covering.
 15. Process equipment, including identification of ordering lead-time, factory testing, and installation.
 16. Pumps and drives, including identification of ordering lead time, factory testing, and installation.
 17. Other mechanical equipment including fans and heating, ventilating, and air conditioning equipment.
 18. Trenching, pipe laying, and trench backfill and compaction.
 19. Piping, fittings, and appurtenances, including identification of ordering and fabrication lead time, layout, installation and testing.
 20. Valves, gates, and operators, including identification of order lead-time, installation, and testing.
 21. Plumbing specialties.
 22. Electric transmission, service, and distribution equipment, including identification of ordering lead-time, and factory testing.
 23. Other electrical work including lighting, heating and cooling, and special systems, including identification of ordering lead-time.
 24. Instrumentation and controls, including identification of ordering lead-time.
 25. Preliminary testing of equipment, instrumentation, and controls.
 26. Commissioning Phase:
 - a. Source Testing.
 - b. Owner Training.
 - c. Installation Testing.
 - d. Functional Testing.
 - e. Clean Water Facility Testing.

27. Process Start-up Phase:
 - a. Process Start-up.
 - b. Process Operational Period.
 - c. Instrumentation and Controls Performance Testing.
28. Substantial completion.
29. Punch list work.
30. Demobilization.

1.07 SUBMITTAL OF PROGRESS SCHEDULES

- A. Submit preliminary and baseline schedule.
- B. Submit, on a monthly basis, updated schedules as specified.
- C. Submit final schedule update as specified.
- D. Submit revised schedules and time impact analyses as specified.
- E. Submit schedules in the media and number of copies as follows:
 1. Three sets of the CPM network and/or bar chart (as specified by the Owner and Engineer's representatives) on D-size sheets. Color-coding to be specified by the Owner.
 2. Three sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
 3. Two sets of CPM Schedule data electronic files stored on CD/DVD or Owner provided flash drive.

1.08 PRELIMINARY SCHEDULE

- A. Submit Preliminary Schedule as defined in the General Conditions and/or Contractor Contract as applicable. Include a detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.
- B. Meet with Engineer's representative within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. Submit revised preliminary schedule within 5 calendar days after meeting.
- C. Submit schedule of costs for all activities on revised Preliminary Schedule.
- D. Schedule of costs:
 1. Schedule of Values required under Section 01292 for first 90 calendar days of Work.
 2. Submittal and acceptance of Preliminary Schedule is condition precedent to making of progress payments under Section 01294 and payments for mobilization costs otherwise provided for in the Contract.
 3. No pay item Work shall commence until Preliminary Schedule and schedule of costs have been accepted by Owner (Owner and Engineer's representatives).
- E. Incorporated unchanged, the accepted Preliminary Schedule as first 90 calendar days of activity in Contractor's Baseline Schedule.

- F. Updated monthly during first 90 calendar days after Notice to Proceed. Updated Preliminary Schedule shall be submitted with the payment application required under Section 01294.

1.09 BASELINE SCHEDULE

- A. No more than 45 calendar days after Notice to Proceed, submit the Baseline Schedule for all Work of the project. Show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.
- B. Acceptance of the Baseline Schedule by the Owner and Engineer's representatives is a condition precedent to making payments as specified in Section 01294 after the first 90 calendar days after Notice to Proceed.

1.10 WEATHER DAYS ALLOWANCE

- A. See General Conditions for Weather Days and Delays.

1.11 REVIEW AND ACCEPTANCE OF SCHEDULES

- A. See General Conditions.
- B. Engineer's representative will review Baseline Schedule, Schedule Updates, Schedule Revisions, and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships and completeness.
- C. Engineer and Owner's representatives will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt.
- D. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to Contractor within 14 calendar days after receipt by Engineer's representative.
- E. Revise and resubmit schedule in accordance with Engineer's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections.
- F. If Engineer requests a meeting the Contractor and all major subcontractors must participate in the meeting with Engineer.
 - 1. Revise and resubmit schedule within 7 calendar days after meeting.
- G. When schedule reflects Owner, Engineer and Contractor's agreement of project approach and sequence, schedule will be accepted by Owner. Use accepted schedule for planning, organizing, and directing the work and for reporting progress.

1.12 SCHEDULE UPDATES

- A. Any update:
 - 1. Prepare update using most recent accepted version of schedule including:
 - a. Actual start dates of activities that have been started.
 - b. Actual finish dates of activities that have been completed.

- c. Percentage of completion of activities that have been started but not finished.
- d. Actual dates on which milestones were achieved.
- e. Update activities by inputting percent complete figures with actual dates.
- f. Use retained logic in preparing Schedule Updates.
- g. When necessary, input remaining durations for activities whose finish dates cannot be calculated accurately with a percent complete figure only.
- h. Revisions to the schedule may be included that have been previously approved as specified in this Section under Revisions to Schedule.

B. Monthly updates:

- 1. Submit written narrative report in conjunction with each Schedule Update including descriptions of the following:
 - a. Activities added to or deleted from the schedule are to adhere to cost and other resource loading requirements.
 - 1) Identify added activities in manner distinctly different from original activity designations.
 - b. Changes in sequence or estimated duration of activities.
 - c. Current or anticipated problems and delays affecting progress, impact of these problems and delays and measures taken to mitigate impact.
 - d. Assumptions made and activities affected by incorporating change order work into the schedule.
- 2. Submit updated schedule and materials specified under Submittal of Progress Schedules, 5 calendar days before the monthly schedule update meeting.
- 3. Since Monthly Schedule Update is submitted with the application for progress payment as required by Section 01294, submittal and acceptance of the monthly Schedule Update is a condition precedent to the making of any progress payments.

C. Weekly progress meeting:

- 1. Update the schedule prior to weekly progress meeting.
 - a. Identify overall progress of each Major Item of Work in the Summary Schedule.
 - b. If there are significant changes to the schedule, submit a written report at the weekly progress meeting.
- 2. Should monthly Schedule Update show project completion earlier than current Contract completion date, show early completion time as schedule activity, identified as "Project Float."
- 3. Should monthly Schedule Update show project completion later than current Contract completion date, prepare and submit a Schedule Revision in accordance with the Revisions to Schedule.

1.13 REVISIONS TO SCHEDULE

A. Submit Revised Schedule within 5 calendar days:

- 1. When delay in completion of any activity or group of activities indicates an overrun of the Contract time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
- 2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
- 3. When the schedule does not represent the actual progress of activities.

4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
 5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.
- B. Create a separate submittal for Schedule Revisions.
1. Comply with schedule updates as specified in this Section.
 2. Do not submit with Schedule Updates.
- C. Schedule Revisions will not be reflected in the schedule until after the revision is accepted by the Owner.
1. This includes Schedule Revisions submitted for the purpose of mitigating a Contractor-caused project delay (Recovery Schedule).

1.14 PAYMENT REQUESTS AND CASH FLOW

- A. As described in the General Conditions and/or Contractor Contract as applicable.

1.15 WEEKLY SCHEDULE

- A. Submit to Engineer's representative, at every weekly progress meeting, a 6-Week Schedule showing the activities completed during the previous week and the Contractor's schedule of activities for following 5 weeks.
- B. Use the logic and conform to the status of the current progress schedule when producing a Weekly Schedule in CPM schedule or a bar chart format. In the event that the Weekly Schedule no longer conforms to the current schedule, Contractor may be required to revise the schedule as specified in this Section.
- C. The activity designations used in the Weekly Schedule must consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. Contractor and Engineer must agree on the format of the Weekly Schedule.

1.16 SCHEDULE OF VALUES

- A. Requirements for Schedule of Values are specified in Section 01292.
- B. Submit, in conjunction with the Progress Schedule, a Schedule of Values identifying costs of all on-site construction activities as generated by the cost loaded schedule. Equate the aggregate of these costs to the Lump Sum Contract Price.

1.17 ADJUSTMENT OF CONTRACT TIMES

- A. Contract Time will be adjusted only for causes specified in Contract Documents.
1. Non-excusable delay: Non-excusable delays include actions or inactions of the Contractor, or events for which the Contractor has assumed contractual responsibility (including actions or inactions of subcontractors, suppliers, or material manufacturers at any tier) that would independently delay the completion of the Work beyond the current Contract completion date). No time extensions will be granted for non-excusable delays.

2. Excusable delay: Events which are unforeseeable, outside the control of, and without the fault or negligence of either the Owner or the Contractor (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date. The Contractor is entitled to a time extension only. No other damages will be approved.
 3. Compensable delay: Actions or inactions of the Owner, or events for which the Owner has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date. The Contractor is entitled to a time extension and delay damages.
 4. Concurrent delay: Concurrent delay is any combination of the above 3 types of delay occurring on the same calendar date.
 - a. Exception to concurrent delay: Cases where the combination consists of 2 or more instances of the same type of delay occurring on the same calendar date. When one cause of delay is Owner-caused or caused by an event which is beyond the control and without the fault or negligence of either the Owner or the Contractor and the other Contractor-caused, the Contractor is entitled only to a time extension and no delay damages.
- B. If the Contractor believes that the Owner has impacted its work, such that the project completion date will be delayed, the Contractor must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the Contractor to an adjustment of contract time.
- C. The Time Impact Analysis:
1. Use the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other Owner-caused delay). Represent the delay event in the schedule by:
 - a. Inserting new activities associated with the delay event into the schedule,
 - b. Revising activity logic, or
 - c. Revising activity durations.
 2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
 3. The Time Impact Analysis submittal must include the following information:
 - a. A fragment of the portion of the schedule affected by the delay event.
 - b. A narrative explanation of the delay issue and how it impacted the schedule.
 - c. A CD containing the schedule file used to perform the Time Impact Analysis.
- D. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the Contractor chooses not to implement the revisions, the Contractor will be entitled to a time extension and no compensation for extended overhead.
- E. Indicate clearly that the Contractor has used, in full, all project float available for the work involved in the request, including any float that may exist between the Contractor's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the contract time.

- F. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
- G. Actual delays in activities which do not affect the critical path work or which do not move the Contractor's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the contract time.
- H. If completion of the project occurs within the specified contract time, the Contractor is not entitled to job-site or home office overhead beyond the Contractor's originally planned occupancy of the site.
- I. Notify Engineer of a request for contract time adjustment. Submit request as specified in General Conditions. In cases where the Contractor does not submit a request for contract time adjustment for a specific change order, delay, or Contractor request within the specified period of time, then it is mutually agreed that the particular change order, delay, or Contractor request has no time impact on the Contract completion date and no time extension is required.
- J. The Engineer will, within 30 calendar days after receipt of a contract time adjustment, request any supporting evidence, review the facts and advise the Contractor in writing.
 - 1. Include the new Progress Schedule data, if accepted by the Owner, in the next monthly Schedule Update.

1.18 SUMMARY SCHEDULE

- A. Provide Summary Schedule, which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.
- B. Submit updated Summary Schedule at weekly progress meetings and after each Schedule Update or Schedule Revision.

1.19 SUBMITTAL SCHEDULE

- A. Submittal Schedule shall include submittals required in the Contract Documents but not limited to Commissioning and Process Start-up Plans, Training Plans, test procedures, operation and maintenance manuals, shop drawings, samples, record documents, and specifically required certificates, warranties, and service agreements.
- B. Preliminary Submittal Schedule:
 - 1. Due date: After Preliminary Schedule has been submitted and accepted by Owner (Plant Superintendent).
 - 2. Format:
 - a. Include submittals anticipated in the first 90 calendar days after Notice-to-Proceed using early start dates.
 - b. Indicate week and month anticipated for each submittal.

- c. Indicate "Priority" submittals where review time can impact Contractor's schedule.
 - 1) "Priority" indication will not alter review times specified in Section 01330.
 - 2) Engineer will endeavor to provide early review of "Priority" submittals where possible.
 - 3. Submittal of Preliminary Submittal Schedule shall be a condition precedent to Owner making progress payments during the first 90 calendar days after Notice to Proceed.
- C. Final Submittal Schedule:
- 1. Due date: After Baseline Schedule has been submitted and accepted by Owner (Plant Superintendent).
 - 2. Format:
 - a. Include submittals using early start dates.
 - b. Include all submittals, including those required in the preliminary schedule of shop drawings and sample submittals.
 - c. Indicate week and month anticipated for each submittal.
 - d. Indicate "Priority" submittals where review time can impact Contractor's schedule.
 - 1) "Priority" indication will not alter review times specified in Section 01330.
 - 2) Engineer will endeavor to provide early review of "Priority" submittals where possible.
 - 3. Submittal of Final Submittal Schedule shall be a condition precedent to Owner making progress payments after the first 90 calendar days after Notice to Proceed.
- D. Provide updated Submittal Schedule with updated schedules if schedule revisions change listing and timing of submittals.

1.20 MANPOWER SCHEDULES

- A. Due date: After Baseline Schedule has been submitted and accepted by Owner.
- B. Format:
 - 1. Schedule histogram depicting total craft manpower and craft manpower for Contractor's own labor forces and those of each subcontractor.
 - 2. Submit electronically on a computer disk and City provided flash drive in Excel format, with 1 paper copy.
- C. Progress payments after the first 90 calendar days after Notice to Proceed will not be made until manpower schedule is provided.

1.21 EQUIPMENT SCHEDULE

- A. Due date: After Baseline Schedule has been submitted and accepted by Owner. (Plant Superintendent)

- B. Format:
 - 1. Tabular report listing each major piece of construction equipment to be used in performing the Work.
 - 2. Include major equipment for Contractor and each subcontractor.
 - 3. Submit electronically on a computer disk in Excel format with 1 paper copy.
- C. Progress payments after the first 90 calendar days after Notice to Proceed will not be made until equipment schedule is provided.

1.22 COMMISSIONING AND PROCESS START-UP SCHEDULE SUBMITTAL

- A. Proposed Commissioning and Process Start-up Schedule:
 - 1. Due date: As specified in Section 01756.
 - 2. Schedule requirements: As specified in Section 01756.
 - 3. Engineer response due within 20 calendar days of receipt.
 - 4. Contractor responsible for updating schedule and resubmitting within 10 calendar days of receipt of Engineer and Owner comments.
- B. The Commissioning and Process Start-up Schedule may not be combined with the Detailed Schedule until Engineer acceptance of the Proposed Commissioning and Process Start-up Schedule.
- C. Commissioning and Process Start-up Schedule monthly update requirements:
 - 1. Highlight percentages of completion, actual start and finish dates, and remaining durations, as applicable.
 - 2. Include activities not previously included in the previously accepted detail work plan Commissioning and Process Start-up Schedule.
 - 3. Change Order required for any change to contractual dates.
 - 4. Reviews of these submittals by Engineer will not be construed to constitute acceptance within the time frames, durations, or sequence of work for each added activity.

1.23 FINAL SCHEDULE SUBMITTAL

- A. The final Schedule Update becomes the As-Built Schedule.
 - 1. The As-Built Schedule reflects the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.
 - 2. Contractor's Project Manager and scheduler sign and certify the As-Built Schedule as being an accurate record of the way the project was actually constructed.
- B. Retainage will not be released until final Schedule Update is provided.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01329

SAFETY PLAN

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Development and maintenance of a Construction Safety Plan.

1.02 REFERENCES

- A. National Fire Protection Association (NFPA):
 - 1. 70E - Standard for Electrical Safety in the Workplace.
- B. Occupational Safety and Health Standards (OSHA).

1.03 CONSTRUCTION SAFETY PLAN (BY CONTRACTOR)

- A. Submit a Safety Plan as required by the General Conditions and/or Contractor Contract and/or as directed by the Owner.
- B. Detail the Methods and Procedures to comply with NFPA 70E, Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Methods and procedures must also comply with the Owner's Safety Plan. Include the following:
 - 1. Identification of the Certified or Licensed Safety Consultant who will prepare, initiate, maintain, and supervise safety programs, and procedures.
 - 2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
 - 3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, safety equipment used in multi-level structures, personal protective equipment (PPE) as required by NFPA 70E.
 - 4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
 - 5. Procedures for reporting safety or health hazards.
 - 6. Procedures to follow to correct a recognized safety and health hazard.
 - 7. Procedures for investigation of accidents, injuries, illnesses, and unusual events that have occurred at the construction site.
 - 8. Periodic and scheduled inspections of general work areas and specific workstations.
 - 9. Training for employees and workers at the jobsite.
 - 10. Methods of communication of safe working conditions, work practices and required personal protection equipment.
 - 11. Provision of a site specific emergency action and evaluation plan.
 - 12. Verify safety plan includes reference to and compliance with latest Owner safety policies.

- C. Assume sole responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of subcontractors, suppliers, and other persons on the jobsite:
 - 1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
 - 2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

- D. Transmit to Owner and Engineer copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements and procedures for submittals.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01292 - Schedule of Values.
 - b. Section 01294 - Applications for Payment.
 - c. Section 01330 - Submittal Procedures.
 - d. Section 01324B - Progress Schedules and Reports.
 - e. Section 01770 - Closeout Procedures.
 - f. Section 03200 - Concrete Reinforcing.

1.02 DEFINITIONS

- A. Certificates: Describe certificates that document affirmations by the Contractor or other entity that the work is in accordance with the Contract Documents.
- B. Extra stock materials: Describe extra stock materials to be provided for the Owner's use in facility operation and maintenance.
- C. Maintenance material submittals: Use this article to categorize maintenance materials submittals requiring no A/E action other than confirmation of receipt under an explanatory heading.
- D. Manufacturer's instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; manufacturer's instructions are not prepared especially for the Work.
- E. Product data: Product data usually consists of manufacturers' printed data sheets or catalog pages illustrating the products to be incorporated into the project.
- F. Samples: Samples are full-size actual products intended to illustrate the products to be incorporated into the project. Sample submittals are often necessary for such characteristics as colors, textures, and other appearance issues.

- G. Spare parts: Describe spare parts necessary for the Owner's use in facility operation and maintenance; identify the type and quantity here, but include the actual characteristics of the spare parts in Product as part of the specification of the product.
- H. Shop drawings: Shop drawings are prepared specifically for the project to illustrate details, dimensions, and other data necessary for satisfactory fabrication or construction that are not shown in the contract documents. Shop drawings could include graphic line-type drawings, single-line diagrams, or schedules and lists of products and their application.
- I. Submittals: Submittals are samples, product data, shop drawings, and others that demonstrate how Contractor intends to conform with the Contract Documents.
- J. Tools: Tools are generally defined as items such as special wrenches, gauges, circuit setters, and other similar devices required for the proper operation or maintenance of a system that would not normally be in the Owner's tool kit.

1.03 GENERAL INSTRUCTIONS

- A. Provide submittals that are specified or reasonably required for construction, operation, and maintenance of the Work.
- B. Provide submittal information from only 1 manufacturer for a specified product. Submittals with multiple manufacturers for 1 product will be rejected without review.
- C. Edit all submittals so that the submittal specifically applies to only the equipment furnished. Neatly cross out all extraneous text, options, models, etc. that do not apply to the equipment being furnished, so that the information remaining is only applicable to the equipment being furnished.
- D. Prepare submittals in the English language. Do not include information in other languages.
- E. Present measurements in customary American units (feet, inches, pounds, etc).
- F. Show dimensions, construction details, wiring diagrams, controls, manufacturers, catalog numbers, and all other pertinent details.
- G. Where multiple submittals are required, provide a separate submittal for each specification section.
 - 1. In order to expedite construction, the Contractor may make more than 1 submittal per specification section, but a single submittal may not cover more than 1 specification section:
 - 2. The only exception to this requirement is when 1 specification section covers the requirements for a component of equipment specified in another section.
 - a. For example, circuit breakers are a component of switchgear. The switchgear submittal must also contain data for the associated circuit breakers, even though they are covered in a different specification section.

- H. Hardcopy submittals:
 - 1. If submittal is more than 200 pages provide hardcopy.
 - 2. Must be clear and legible, and of sufficient size for presentation of information.
 - a. Minimum page size will be 8 1/2 inches by 11 inches.
 - b. Maximum page size will be 11 inches by 17 inches.

- I. Submittals in electronic media format:
 - 1. General: Provide all information In PC compatible format using Windows Operating System as used by the Engineer and Owner.
 - 2. Text: Provide text documents and manufacturer's literature using current version of Adobe Acrobat (i.e. PDF extension) as utilized by the Owner and Engineer.
 - 3. Graphics: Provide all graphic submittals (drawings, diagrams) utilizing current version of Adobe Acrobat (i.e. PDF extension) as utilized by the Engineer and Owner.

- J. Approved Material List:
 - 1. General: Provide the Approved Material List that documents all products that have been determined to be without exceptions through the submittal process. Maintain and update the list throughout the construction period. Provide Owner and Engineer with current copy of list. Provide the list electronically in EXCEL file.
 - 2. Content: Provide Approved Material List in log form with columns titled, "Spec. Section", "Paragraph", "Submittal No.", "Acceptance Date", "Product Description", and "Manufacturer Name". Include only products submitted and found to be without exceptions, that is, the review response indicating "Reviewed-No Corrections Noted", "Submittal Not Reviewed, Filed for Record", or "Submittal Not Reviewed".

1.04 SUBMITTAL CONTENTS

- A. Submittal Transmittal Form is provided in Attachment No. 1 of this Section.
 - 1. Substitute forms require Engineer approval based on forms providing the same information, statements, and certifications.
 - 2. Required submittal numbering format: Section number-sequential number-resubmittal number:
 - a. Example: 03200-002-1:
 - 1) "03200" indicates the affected specification is Section 03200.
 - 2) "002" indicates the second submittal under this section.
 - 3) "1" indicates the first resubmittal of the Submittal 03200-002.
 - 3. Specification section: Include with each submittal a copy of the relevant specification section, including relevant addendum updates.
 - a. Indicate in the left margin, next to each pertinent paragraph, either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).
 - b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
 - 4. Drawings: Include with each submittal a copy of the relevant Drawing, including relevant addendum updates.
 - a. Indicate either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).

- b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
 - c. Provide field dimensions and relationship to adjacent or critical features of the Work or materials.
5. Other information or materials as needed.

1.05 SUBMITTAL FORMAT

- A. Fully indexed with a tabbed divider for every component.
- B. Sequentially number pages within the tabbed sections:
 1. Submittals that are not fully indexed and tabbed with sequentially numbered pages, or are otherwise unacceptable, will be returned without review.
- C. Organize submittals in exactly the same order as the items are referenced, listed, and/or organized in the specification section.
- D. For submittals that cover multiple devices used in different areas under the same specification section, the submittal for the individual devices must list the area where the device is used.
- E. Attachments:
 1. Specification section: Include with each submittal a copy of the relevant specification section.
 - a. Indicate in the left margin, next to each pertinent paragraph, either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).
 - b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
 2. Drawings: Include with each submittal a copy of the relevant Drawing, including relevant addendum updates.
 - a. Indicate either compliance with a check (√) or deviation with a consecutive number (1, 2, 3).
 - b. Provide a list of all numbered deviations with a clear explanation and reason for the deviation.
 - c. Provide field dimensions and relationship to adjacent or critical features of the Work or materials.
- F. Contractor: Prepare submittal information in sufficient detail to show compliance with specified requirements.
 1. Determine and verify quantities, field dimensions, product dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
 2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.
- G. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.
- H. Consolidate electronic format submittals with multiples pages into a single file.

1.06 SUBMITTAL METHOD

- A. Submittals in electronic media format:
 - 1. General: Provide all information in PC-compatible format using Windows® operating system as utilized by the Owner and Engineer.
 - 2. Text: Provide text documents and manufacturer's literature in Portable Document Format (PDF).
 - 3. Graphics: Provide graphic submittals (drawings, diagrams, figures, etc.) utilizing Portable Document Format (PDF).

1.07 SUBMITTAL PROCEDURE

- A. Contractor: Prepare submittal information in sufficient detail to show compliance with specified requirements.
 - 1. Determine and verify quantities, field dimensions, product dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
 - 2. Coordinate submittal with other submittals and with the requirements of the Contract Documents.
 - 3. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions.
- B. Contractor: stamp, sign and date submittals indicating review and approval:
 - 1. Signature indicates Contractor has satisfied submittal review responsibilities and constitutes Contractor's written approval of submittal.
 - 2. Submittals without Contractor's signature will be returned to the Contractor un-reviewed. Subsequent submittal of this information will be counted as the first resubmittal.
- C. Engineer: Review submittal and provide response.
 - 1. Review description:
 - a. Engineer will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.
 - b. Engineer's review of submittals shall not release Contractor from Contractor's responsibility for performance of requirements of Contract Documents. Neither shall Engineer's review release Contractor from fulfilling purpose of installation nor from Contractor's liability to replace defective work.
 - c. Engineer's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents.
 - d. Engineer's review does not extend to:
 - 1) Accuracy of dimensions, quantities, or performance of equipment and systems designed by Contractor.
 - 2) Contractor's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
 - 3) Safety precautions or programs related to safety which shall remain the sole responsibility of the Contractor.
 - e. Engineer can accept or reject any exception at their sole discretion.

2. Review timeframe:
 - a. Except as may be provided in technical specifications, a submittal will be returned within 14 days.
 - b. When a submittal cannot be returned within the specified period, Engineer will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.
 - c. Critical submittals:
 - 1) Contractor will notify Engineer in writing that timely review of a submittal is critical to the progress of Work.
 - d. Engineer will provide decision on request.
 - 1) Written acceptance of request.
 - a) Written agreement by Engineer to reduce submittal review time will be made only for unusual situations.
 - 2) Written rejection of request.
3. Schedule delays:
 - a. No adjustment of Contract Times or Contract Price will be allowed due to Engineer's review of submittals, unless all of the following criteria are met:
 - 1) Engineer has failed to review and return first submission within the agreed upon time frame.
 - 2) Contractor demonstrates that delay in progress of Work is directly attributable to Engineer's failure to return submittal within time indicated and accepted by Engineer.
4. Review response will be returned to Contractor with one of the following dispositions.
 - a. Approved:
 - 1) No Exceptions:
 - a) There are no notations or comments on the submittal and the Contractor may release the equipment for production.
 - 2) Make Corrections Noted - See Comments:
 - a) The Contractor may proceed with the work, however, all notations and comments must be incorporated into the final product.
 - b) Resubmittal not required.
 - 3) Make Corrections Noted - Confirm:
 - a) The Contractor may proceed with the work, however, all notations and comments must be incorporated into the final product.
 - b) Submit confirmation specifically addressing each notation or comment to the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the confirmation.
 - b. Not approved:
 - 1) Correct and resubmit:
 - a) Contractor may not proceed with the work described in the submittal.
 - b) Contractor assumes responsibility for proceeding without approval.
 - c) Resubmittal of complete submittal package is required within 30 calendar days of the date of the Engineer's submittal review response.
 - 2) Rejected - See Remarks:
 - a) Contractor may not proceed with the work described in the submittal.

- b) The submittal does not meet the intent of the Contract Documents. Resubmittal of complete submittal package is required with materials, equipment, methods, etc. that meet the requirements of the Contract Documents.
 - 3) Receipt acknowledged: Filed for record:
 - a) This is used in acknowledging receipt of informational submittals that address means and methods of construction such as schedules and work plans, conformance test reports, health and safety plans, etc.
- D. Contractor: Prepare resubmittal, if applicable.
 - 1. Clearly identify each correction or change made.
 - 2. Include a response in writing to each of the Engineer's comments or questions for submittal packages that are resubmitted in the order that the comments or questions were presented throughout the submittal.
 - a. Acceptable responses to Engineer's comments are listed below:
 - 1) "Incorporated" Engineer's comment or change is accepted and appropriate changes are made.
 - 2) "Response" Engineer's comment not incorporated. Explain why comment is not accepted or requested change is not made. Explain how requirement will be satisfied in lieu of comment or change requested by Engineer.
 - b. Reviews and re-submittals:
 - 1) Suppliers shall provide re-submittals which include responses to all submittal review comments separately and at a level of detail commensurate with each comment.
 - 2) Supplier responses shall indicate how the supplier resolved the issue pertaining to each review comment. Responses such as "acknowledged" or "noted" are not acceptable.
 - 3) Re-submittals which do not comply with this requirement may be rejected and returned without review.
 - 4) Contractor shall be allowed no extensions of any kind to any part of their contract due to the rejection of non-compliant submittals.
 - 5) Submittal review comments not addressed by the Contractor in re-submittals shall continue to apply whether restated or not in subsequent reviews until adequately addressed by the Contractor to the satisfaction of the reviewing and approving authority.
 - c. Any resubmittal that does not contain responses to the Engineer's previous comments shall be returned for Revision and Resubmittal. No further review by the Engineer will be performed until a response for previous comments has been received.
 - 3. Re-submittal timeframe:
 - a. Contractor shall provide re-submittal within 15 days.
 - b. When a re-submittal cannot be returned within the specified period, Contractor shall notify Engineer in writing.
 - 4. Review costs:
 - a. Costs incurred by Owner as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by Contractor.
 - b. Reimbursement to Owner will be made by deducting such costs from Contractor's subsequent progress payments.

1.08 SUBMITTALS

- A. Shop Drawings:
 - 1. Contractor to field verify elevation, coordinates, and pipe material for pipe tie-in prior to the preparation of shop drawings.
 - 2. Details:
 - a. Fabrication drawings: drawn to scale and dimensioned.
 - b. Front, side, and, rear elevations, and top and bottom views, showing all dimensions.
 - c. Locations of conduit entrances and access plates.
 - d. Component layout and identification.
 - e. Weight.
 - f. Finish.
 - g. Temperature limitations, as applicable.
 - h. Nameplate information.
 - 3. Minor or incidental products and equipment schedules:
 - a. Details:
 - 1) Shop Drawings of minor or incidental fabricated products will not be required, unless requested.
 - 2) Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.
- B. Product Information:
 - 1. Product Data:
 - a. Details:
 - 1) Supplier name and address.
 - 2) Subcontractor name and address.
 - b. Include:
 - 1) Catalog cuts.
 - 2) Bulletins.
 - 3) Brochures.
 - 4) Manufacturer's Certificate of Compliance: signed by product manufacturer along with supporting reference data, affidavits, and tests, as appropriate.
 - 5) Manufacturer's printed recommendations for installation of equipment.
 - 6) Quality photocopies of applicable pages from manufacturer's documents.
 - 2. Completely fill out a Motor Data Sheet, as specified in Section 16405, for every motor furnished:
 - a. Submit one copy of the Motor Data Sheet to the Engineer for review as part of the associated equipment submittal.
 - 3. Samples:
 - a. Number of samples: 3 minimum.
 - b. Details:
 - 1) Submit labeled samples.
 - 2) Samples will not be returned.

- 3) Provide samples from manufacturer's standard colors, materials, products, or equipment lines.
 - a) Clearly label samples to indicate any that represent non-standard colors, materials, products, or equipment lines and that if selected, will require an increase in Contract Time or Contract Price.
 4. Minor or incidental products and equipment schedules:
 - a. Details:
 - 1) Shop Drawings of minor or incidental fabricated products will not be required, unless requested.
 - 2) Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.
- C. Design calculations:
 1. Details:
 - a. Defined in technical sections.
 - b. Calculations must bear the original seal and signature of a Professional Engineer licensed in the state where the project is located and who provided responsible charge for the design.
- D. Qualifications Statements:
 1. Details:
 - a. Defined in technical sections.
 - b. Licensing documentation.
 - c. Certification documentation.
 - d. Education documentation.
- E. Quality assurance/control submittals:
 1. Mill test reports:
 - a. Details:
 - 1) Submit certified copies of factory and mill test reports.
 - 2) Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.
 - 3) Pay for mill and factory tests.
 2. Test reports:
 - a. Details:
 - 1) Include the following information:
 - a) A description of the test.
 - b) List of equipment used.
 - c) Name of the person conducting the test.
 - d) Date and time the test was conducted.
 - e) Ambient temperature and weather conditions.
 - f) All raw data collected.
 - g) Calculated results.
 - h) Clear statement if the test passed or failed the requirements stated in Contract Documents.
 - i) Signature of the person responsible for the test.
 3. Factory Acceptance Test:
 - a. Details: Include complete test procedure and all forms to be used during test.

4. Certificates:
 - a. Details: Defined in technical sections.
 5. Manufacturers' field reports:
 - a. Details: Certificate of proper installation.
 6. Field Samples:
 - a. Details: Defined in technical sections.
 7. Test Plans:
 - a. Details: Defined in technical sections.
- F. Project management submittals:
1. Applications for payment:
 - a. Details:
 - 1) As specified in Section 01294.
 2. Schedules:
 - a. Details:
 - 1) Progress schedules: As specified in Section 01324B.
 - 2) Schedule of values: As specified in Section 01292.
 - 3) Schedule of submittals: As specified in Section 01324B.
 3. Progress reports and quantity charts:
 - a. Details: As specified in Section 01324B.

1.09 CLOSEOUT SUBMITTALS

- A. Provide closeout submittals as specified in Section 01770.
- A. Operation and Maintenance Manuals: final documents shall be submitted as specified in Section 01782.
- B. Extra materials, spare parts, etc.: Submittal forms shall indicate when actual materials are submitted.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

CONTRACTOR SUBMITTAL TRANSMITTAL FORM



CONTRACTOR SUBMITTAL

TRANSMITTAL

Owner: City of Daytona Beach

Submittal Number:

Contractor:

Package Number:

Date:

Project Number:

TO: CAROLLO ENGINEERS Eola Park Center, 200 E. Robinson Center, Suite 1400, Orlando, FL 32801	
From: Enter Name & Address Here	
SPECIFICATION NO.	SUBJECT OF SUBMITTAL / EQUIPMENT SUPPLIER

Check Either (A) or (B):

- (A) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings with no exceptions.
- (B) We have verified that the equipment or material contained in this submittal meets all the requirements specified in the project manual or shown on the contract drawings except for the following deviations (list deviations):

General Contractor's Authorized Signature: _____

PM/CM Office Use

Date Received GC to PM/CM: _____

Date Received PM/CM to Reviewer: _____

Date Received Reviewer to PM/CM: _____

Date Sent PM/CM to GC: _____

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SECTION 01400

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION

- A. Section includes: Contractor's responsibilities for temporary facilities and utilities that the Contractor may require during construction.

1.02 SCOPE OF WORK

- A. Provide temporary facilities required which may include, but are not necessarily limited to, the following:
 - 1. Storage sheds.
 - 2. Temporary lighting and electrical service.
 - 3. Temporary fire protection.
 - 4. Temporary office trailer, including temporary utilities.
- B. Site Offices - Site offices for City will not be required for this project. Contractor shall provide adequately sized mobile trailer(s) with furnished offices to be used for the duration of the Contract for its own personnel and its subcontractors on the job site at locations approved by the City. Such offices shall be maintained in a clean, orderly condition. An authorized representative shall be present at all times while Work is in progress.
- C. The Contractor shall provide the following temporary utilities for the office trailers:
 - 1. Potable water.
 - 2. Sanitary sewer.
 - 3. Electrical.
 - 4. Telephone.
 - 5. Internet.
- D. The Contractor shall be responsible for costs of installing the utilities from the points of connection, maintenance, and removal of all materials for all temporary utilities. The Contractor shall also be responsible for installation, maintenance and removal of the electrical power, telephone, internet, lighting, potable water, and sanitary sewer utilities. Additionally, the Contractor shall be responsible for maintenance and removal of parking areas around the Contractor's office trailers. This shall include policing the area of litter and debris, and weed control.
- E. Temporary Water:
 - 1. Furnish and install temporary water service for use throughout construction period or until required.
 - 2. Provide separate supply of potable water. If supplied from City source, the system shall be protected by approved backflow devices.
 - 3. Maintain strict supervision of use of temporary services.
 - 4. Cost of installation and Operation - Pay costs for temporary water supply used by all trades, including costs of installation, maintenance, and removal of pipe and equipment.

F. Temporary Electrical and Lighting:

1. Furnish, install, and maintain adequate temporary lighting and electric power service for construction needs throughout the construction period. All temporary electrical facilities shall meet the requirements of all pertinent building codes. The work may include the following:
 - a. Power centers for miscellaneous tools and equipment used in construction work.
 - 1) Provide step-down transformer(s) for converting the power supply to 120-volt power.
 - 2) Provide circuit breaker protection for each outlet.
 - 3) Provide equipment grounding continuity for entire system.
 - 4) Users shall provide grounded, UL approved extension cords from power center to point of operation.
 - 5) Comply with N.E.C. regarding ground fault protection.
 - b. Power for testing and checking equipment and systems.
 - c. Power for welding units and for other equipment having special power requirements.
 - d. Emergency power for those situations involving work on existing facilities where loss of construction power would be detrimental to the facility.
2. Pay costs of, installation, maintenance, and removal of temporary electrical services used.
3. Maintain strict supervision of use of temporary services.
4. If required, provide a minimum 120-volt, single phase, 60 hertz electric power service to the site.

G. Temporary Sanitary Facilities:

1. Furnish, install, and maintain temporary sanitary facilities for use throughout construction period.
 - a. Enclosed toilet facilities for construction personnel. Separate facilities will be provided for men and women.
 - b. Potable water for construction personnel:
 - 1) Portable containers to dispense drinking water.
2. Minimum number of fixtures.
3. Maintain strict supervision of use of facilities.
4. Pay for costs of installation and operation including service charges for use of portable units, costs of water or ice, costs for temporary sanitary facilities.
5. Obtain acceptance of City's Representative for all locations.
6. Enclosure for toilet facilities shall be weatherproof, sight proof, sturdy, temporary enclosures.

H. Contractor Employee Parking:

1. Contractor employee parking shall be allowed in only those areas approved by the City's Representative. The Contractor is to submit a plan of intended parking areas for approval 30 days prior to mobilizing on site. The plan shall include the proposed design and construction of the parking areas if required.
2. The Contractor is to maintain strict supervision of use of the parking areas. The Contractor is to maintain, service and clean the areas acceptable to the City.

- I. Project Signs:
 - 1. Furnish and install project signs directing deliveries and others from the front gate to the project site. Signs shall be placed as directed by the City and shall be maintained and remain in good condition for the life of the construction period.

- J. Contractor and Subcontractors will not store any equipment, incidentals etc. from other job site(s) or project(s) not related to this project on-site at any time.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01410

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Regulatory authorities and codes:
 - 1. Building Code.
 - 2. Electrical Code.
 - 3. Fire Code.
 - 4. Mechanical Code.
 - 5. Plumbing Code.
 - 6. City of Daytona Beach Engineering Standards.

1.02 AUTHORITIES HAVING JURISDICTION

- A. Building Department: City of Daytona Beach.
- B. Fire Department: City of Daytona Beach.

1.03 APPLICABLE CODES

- A. Florida Building Commission (FBC):
 - 1. Building code:
 - a. Florida Building Code: (5th Edition) 2014.
 - 2. Electrical code:
 - a. National Electrical Code: NEC 2011.
 - 3. Energy Conservation:
 - a. Florida Energy Conservation Code - 2014
 - 4. Fire prevention code:
 - a. Florida Fire Prevention Code - 2014.
 - 5. Fuel gas code:
 - a. Florida Building Code: Fuel Gas - 2014.
 - 6. Mechanical code:
 - a. Florida Building Code: Mechanical - 2014.
 - 7. Plumbing code:
 - a. Florida Building Code: Plumbing Draft - 2014.
 - 8. Test protocols:
 - a. Florida Building Code: Test Protocols for High-Velocity Hurricane Zones - 2014.
- B. Local regulatory requirements.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01420

TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. City will employ and pay for services of an independent testing laboratory to perform all inspection and testing as required by the Contract Documents. This may include, but is not limited to testing of soil, concrete, asphalt, or structural connections and other such tests which the Owner and Engineer deems necessary.

1.02 IMPLEMENTATION

- A. City Hired Laboratory Responsibilities
 1. Meet "Recommended Requirements for Independent Laboratory Qualifications" latest edition, published by American Council of Independent Laboratories and be authorized/certified to perform work in the state of Florida.
 2. Cooperate with Owner, Engineer, and Contractor, provide qualified personnel promptly on notice.
 3. Perform specified inspections, sampling, cylinder breaks and testing of materials and methods of construction:
 - a. Comply with specific standards, ASTM, and other recognized authorities.
 - b. Ascertain compliance with requirements of Contract Documents.
 4. Promptly notify the Engineer and Contractor of irregularities or deficiencies of work which are observed during performance of services.
 5. Promptly submit five copies of reports of inspections and tests to Owner and Engineer, including:
 - a. Date Issued.
 - b. Project title and Engineer's Job Number.
 - c. Testing laboratory name and address.
 - d. Name and signature of the inspector.
 - e. Date of inspection or sampling.
 - f. Record of temperature and weather.
 - g. Date of test.
 - h. Identification of product.
 - i. Location in project.
 - j. Type of inspection or test.
 - k. Observations regarding compliance with Contract Documents.
 6. Perform additional services as required by the Contractor and/or Owner.
 7. Laboratory will not be authorized to:
 - a. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Approve or accept any portion of work.
 - c. Perform any duties of the Contractor.
- B. Contractor's Responsibilities:
 1. City will hire an independent testing laboratory and pay for all the on-site testing of soil, asphalt, concrete and any other material processes or activities deemed necessary, or as required, by the Contract Documents.

2. Cooperate with laboratory personnel, provide access to work, and to Subcontractor's, and Suppliers operations.
3. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
4. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other materials mixes which require control by the testing laboratory.
5. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. Engineer may require Contractor to provide statements or certificates from the manufacturers or fabricators the materials and equipment provided by them are manufactured or fabricated in full compliance with the approved specifications for quality and workmanship. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no charge to the Owner shall be allowed on account of such testing and certification.
6. Furnish 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. For storage and curing of test samples.
7. Notify laboratory, Owner and Engineer sufficiently in advance of the operations to allow for laboratory assignment of personnel and scheduling of tests.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01460

CONTRACTOR QUALITY CONTROL PLAN

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Contractor Quality Control Plan.

1.02 SUBMITTALS

- A. Qualifications of the Contractor's Quality Control (CQC) Plan Manager must include all qualifying registrations and show that the candidate has had experience (minimum 10 years) on projects of similar type and size.
- B. Contractor's Daily Quality Control Report: Submit to Engineer within 1 day of completion of each inspection.
- C. Daily Inspection Report: Submit to Engineer at the end of each working day or no later than prior to the beginning of the next working day.

1.03 CONTRACTOR'S INSPECTION OF THE WORK

- A. Work performed by Contractor shall be inspected by the Contractor's CQC Plan Manager. Non-conforming Work and any safety hazards in the Work area shall be noted and promptly corrected.
- B. No materials or equipment shall be used in Work without inspection and acceptance by Contractor's CQC Plan Manager.

1.04 QUALIFICATIONS

- A. Contractor's CQC Plan Manager: Demonstrate having performed similar CQC functions on similar type projects. Submit records of personnel experience, training, and qualifications.

1.05 COVERING WORK

- A. Whenever Contractor intends to backfill, bury, cast in concrete, or otherwise cover any Work, notify Engineer not less than 24 hours in advance to request inspection before beginning any such Work of covering. Failure of Contractor to notify Engineer in accordance with this requirement shall be resolved according to the General Conditions.

1.06 REJECTED WORK

- A. Failure to promptly remove and replace rejected Work will be considered a breach of this Contract, and Owner may proceed under provisions of the General Conditions.

1.07 CONTRACTOR'S QUALITY CONTROL PROGRAM

- A. General: Establish and execute a Quality Control (CQC) Plan for Work. The plan shall establish adequate measures for verification and conformance to defined requirements by Contractor personnel and lower-tier Subcontractors (including Fabricators, Suppliers, and Subcontractors). This program shall be described in a Plan responsive to this Section.
- B. CQC personnel:
1. Contractor's CQC Plan Manager shall report to a Senior Project Manager of the Contractor and shall have no supervisory or managerial responsibility over the workforce.
 2. The Contractor CQC Plan Manager shall be on-site as often as necessary, but not less than the daily working hours specified in the Contract Documents to remedy and demonstrate that Work is being performed properly and to make multiple observations of Work in progress.
 3. The Contractor is to furnish personnel with assigned CQC functions reporting to the CQC Manager. Persons performing CQC functions shall have sufficient qualifications, authority, and organizational freedom to identify quality problems and to initiate and recommend solutions.
- C. CQC Plan:
1. Contractor's CQC Plan shall include a statement by the Project Manager designating the CQC Plan Manager and specifying the authority delegated to the CQC Plan Manager to direct cessation or removal and replacement of defective Work.
 2. Describe the CQC program and include procedures, work instructions, and records. Describe methods relating to areas that require special testing and procedures as required by the specifications.
 3. Include specific instructions defining procedures for observing Work in process and comparing this Work with the Contract requirements (organized by specifications section).
 4. Describe procedures to ensure that equipment or materials that have been accepted at the Site are properly stored, identified, installed, and tested.
 5. Include procedures to verify that procured products and services conform to the requirements of the Specifications. Requirements of these procedures shall be applied, as appropriate, to lower-tier Suppliers and/or Subcontractors.
 6. Startup and testing quality control: Include procedures to verify that the startup and testing requirements of the Contract Documents are integrated into the Contractor's CQC Plan and conform to the requirements of the Specifications. Requirements of these procedures shall be applied, as appropriate, to the Contractor and the lower-tier Suppliers and/or Subcontractors.
 7. Include instructions for recording inspections and requirements for demonstrating through the Daily Inspection Reports that Work inspected was in compliance or a deficiency was noted and action to be taken.
 8. Procedures to preclude the covering of deficient or rejected Work.
 9. Procedures for halting or rejecting Work.
 10. Procedures for resolution of differences between the CQC Plan Manager and the production personnel.
 11. Identify contractual hold/inspection points as well as any Contractor-imposed hold/inspection points.

- D. Daily Inspection Report: Include, at a minimum:
1. Inspection of specific work.
 2. Quality characteristics in compliance.
 3. Quality characteristics not in compliance.
 4. Corrective/remedial actions taken.
 5. Statement of certification.
 6. CQC Manager's signature.
 7. Information provided on the daily report shall not constitute notice of delay or any other notice required by the Contract Documents.
- E. Deficient and Non-conforming Work and Corrective Action: Include procedures for handling deficiencies and non-conforming Work. Deficiencies and non-conforming Work are defined as documentation, drawings, material, equipment, or Work not conforming to the indicated requirements or procedures. The procedure shall prevent non-conformances by identification, documentation, evaluation, separation, disposition, and corrective action to prevent reoccurrence. Conditions having adverse effects on quality shall be promptly identified and reported to the senior level management. The cause of conditions adverse to quality shall be determined and documents and measures implemented to prevent recurrence. In addition, at a minimum, this procedure shall address:
1. Personnel responsible for identifying deficient and non-complying items within Work.
 2. How and by whom deficient and non-compliant items are documented "in the field."
 3. The personnel and process utilized for logging deficient and non-compliant Work at the end of each day onto a deficiency log.
 4. Tracking processes and tracking documentation for deficient and non-conforming Work.
 5. Personnel responsible for achieving resolution of outstanding deficiencies.
 6. Include detailed procedures for the performance and control of special process (e.g., welding, soldering, heat treating, cleaning, plating, nondestructive examination, etc.).
- F. Audits: The CQC program shall provide for regularly scheduled documented audits to verify that CQC procedures are being fully implemented by Contractor and its Subcontractors. Audit records shall be made available to Engineer upon request.
- G. Documented control/quality records:
1. Establish methods for control of Contract Documents that describe how Drawings and Specifications are received and distributed to assure the correct issue of the document being used. Describe how record document/drawing data are documented and furnished to Engineer.
 2. Maintain evidence of activities affecting quality. Including operating logs, records of inspection, audit reports, personnel qualification, and certification records, procedures, and document review records.
 3. Maintain quality records in a manner that provides for timely retrieval and traceability. Protect quality records from deterioration, damage, and destruction.
 4. Develop a list of specific records as required by the Contract Documents that will be furnished to Engineer at the completion of activities.

- H. Acceptance of CQC Plan: Engineer's acceptance of the CQC Plan shall not relieve Contractor from any of its obligations for performance of Work. Contractor's CQC staffing is subject to Engineer's review and continued acceptance. Owner, at its sole option, and without cause, may direct Contractor to remove and replace the CQC Plan Manager.
1. Acceptance of the CQC Plan by the Engineer is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction.
 2. After acceptance of the CQC Plan, notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01568

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Contractor shall prepare an appropriate Stormwater Pollution Prevention Plan (SWPPP) for this project. Coordinate with Owner to develop the SWPPP based on existing SWPPP prepared by the Owner for the treatment plant. Contractor shall provide, maintain, and remove temporary erosion and sedimentation controls according to the Stormwater Pollution Prevention Plan (SWPPP) as required by the Florida Department of Environmental Protection (FDEP). All projects that will disturb one (1) acre of land or more shall submit the notice set forth in the FDEP Form 62-621.300(4)(b) to FDEP to obtain the acknowledgement letter with the FDEP identification number of the Project prior to commencement of any construction activity. The Contractor is responsible for keeping the FDEP permit acknowledgement letter and the SWPPP at the project site at all times for projects over one (1) acre. The total disturbance for this project is estimated to be less than one (1) acres and will not require a notice to the FDEP.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 IMPLEMENTATION

- A. The Contractor shall implement temporary controls to prevent soil erosion from the Project site caused by stormwater runoff, soil tracking by equipment, and/or wind. Temporary controls shall be implemented as shown on the drawings. Best Management Practices (BMPs) included in the SWPPP such as installation of silt fence, measures at construction entrances and exits that prevent soil tracking, dust control, and stabilizing of stockpiles shall be installed and maintained by the Contractor. The Contractor shall be responsible for implementing any additional BMPs that are necessary to comply with Federal, State and Local laws and regulations at no additional cost to the City. The Contractor shall notify the Engineer of any required changes and modify the SWPPP accordingly subject to the City approval.
- B. Sedimentation control shall be implemented according to the SWPPP and must prevent turbid stormwater runoff greater than 29 nephelometric turbidity units (NTU) turbidity from leaving the Project site. BMPs shall be installed and maintained by the Contractor according to the SWPPP. No bay haes shall be used. Dewatering must be done by installing well point systems or any other City approved method that will only discharge clear water with a turbidity level in compliance with allowable standards.

3.02 COMPLETION

- A. The Contractor shall clean debris and soil from all new and existing stormwater pipes and structures within the Project area/site (as applicable) after the construction is completed. The Contractor shall clean debris and soil from all existing storm pipes and structures outside the Project site if these materials originated from the Project site. The Contractor shall remove any soil deposits at outfalls from pipes in lakes or ponds that were caused by the construction. The Contractor shall remove all erosion control equipment after the Project site is stabilized and storm system is cleaned. The foregoing items must be completed for the Work to be determined to have reached Final Completion.

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Product requirements; product selection; product options and substitutions; quality assurance; delivery, handling, and storage; and manufacturer's instructions.
- B. Related section:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01756 - Testing, Training and Facility Start-up.
 - b. Section 01782 - Operation and Maintenance Data.
 - c. Section 09960 - High-Performance Coatings.

1.02 DEFINITIONS

- A. Execution: Inclusive of performance, workmanship, installation, erection, application, field fabrication, field quality control, and protection of installed products.
- B. Products: Inclusive of material, equipment, systems, shop fabrications, mixing, source quality control.

1.03 REFERENCES

- A. American National Standards Institute (ANSI).

1.04 PRODUCT REQUIREMENTS

- A. Comply with Specifications and referenced standards as minimum requirements.
- B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified. Note several product specifications name only one supplier and the Contractor in such circumstances shall offer product from the named supplier only. Where one or more suppliers are named, Contractor shall offer products from the named suppliers only.
- C. Provide identical products when products are required in quantity.

- D. Provide products with interchangeable parts whenever possible.
- E. Require each equipment manufacturer to have maintenance facilities meeting the following requirements:
 - 1. Minimum 3 years operational experience.
 - 2. Location in continental United States.
 - 3. Equipment and tools capable of making repairs.
 - 4. Staff qualified to make repairs.
 - 5. Inventory of maintenance spare parts.

1.05 PRODUCT SELECTION

- A. When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products that meet or exceed reference standard and Specifications.
- B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
 - 1. Products by one of named manufacturers that meet or exceed Specifications.
 - 2. Products from other manufacturers will not be accepted.
- C. When products are specified with names of manufacturers and model numbers or catalog designations, provide:
 - 1. Products with model numbers or catalog designations by one of named manufacturers.
 - 2. Products from other manufacturers will not be accepted.
- D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
 - 1. Products specified by brand or trade name, model number, or catalog designation.
 - 2. Product(s) by one of the named manufacturers submitted "as equal" with requirements of the specification shall meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
 - 3. Products from other manufacturers will not be accepted.
- E. When Products are specified with name of manufacturers followed by "or Approved Equal," other manufacturers shall meet the following requirements:
 - 1. Manufacturers not listed in this specifications will need to submit the following to be considered as "Approved Equal" and shall meet the following qualification requirements:
 - a. The manufacturer and the business shall have at least 10 years of experience in the design and manufacture of the equipment. As part of the submittal package described below, the manufacturer shall submit the following:
 - 1) Evidence that equipment of similar capacity and service capability has been in successful operation for at least 5 years in at least 10 separate installations.
 - 2) If above condition is met then comply with the following.

2. Submit the following:
 - a. Submit a written formal request to the Owner for consideration of the product a minimum 10 days before opening of the bids.
 - b. Owner will notify initial opinion and request for additional information within 5 working days of receiving the formal request.
 - c. Owner will notify in writing of decision of acceptance or rejection in an addendum before the opening of the bids.
3. Formal substitution request contents:
 - a. Manufacturer's literature including:
 - 1) Manufacturer's name and address.
 - 2) Product name.
 - 3) Product description.
 - 4) Reference standards.
 - 5) Certified performance and test data of equipment offered for similar service at other full-scale installations.
 - 6) Operation and maintenance data.
 - b. Shop drawings, if available.
 - c. Reference projects where the product has been successfully used:
 - 1) Name and address of project.
 - 2) Year of installation.
 - 3) Year placed in operation.
 - 4) Name of product installed.
 - 5) Point of contact: Name and phone number.
 - d. Itemized comparison of the proposed substitution with product specified including a list of significant variations:
 - 1) Design features.
 - 2) Design dimensions. Certify the proposed equipment will fit within the existing available space with no modifications to any structures or other equipment and shall have sufficient access on all sides for proper operation and maintenance. Manufacturer shall be fully responsible to field verify all available space.
 - 3) Installation requirements.
 - 4) Operations and maintenance requirements.
4. Substitutions will not be considered for acceptance under the following conditions:
 - a. No formal substitution request is made.
 - b. Substitution requests are submitted after the deadline.
5. Owner's decision on a substitution requests will be final and binding.
 - a. Approved substitutions will be considered at bid opening.
6. Requests for time extensions and additional costs based on submission of, approval of, or rejection of substitutions will not be allowed.

1.06 QUALITY ASSURANCE

- A. Employ entities that meet or exceed specified qualifications to execute the Work.
- B. Inspect conditions before executing subsequent portions of the Work. Accept responsibility for correcting unsatisfactory conditions upon executing subsequent portions of the Work.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

1.07 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. Prepare products for shipment by:
 - 1. Applying grease and lubricating oil to bearings and similar items.
 - 2. Separately packing or otherwise suitably protecting bearings.
 - 3. Tagging or marking products to agree with delivery schedule or shop drawings.
 - 4. Including complete packing lists and bills of material with each shipment.
 - 5. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.
 - 6. Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.

- B. Mandatory requirements prior to shipment of equipment:
 - 1. Engineer accepted shop drawings.
 - 2. Engineer accepted Manufacturer's Certificate of Source Testing as specified in Section 01756.
 - 3. Submit draft operations and maintenance manuals, as specified in Section 01782.

- C. Transport products by methods that avoid product damage. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

- D. Provide equipment and personnel to handle products by methods to prevent soiling or damage.

- E. Upon delivery, promptly inspect shipments:
 - 1. Verify compliance with Contract Documents, correct quantities, and undamaged condition of products.
 - 2. Immediately store and protect products and materials until installed in Work.
 - 3. Acceptance of shipment does not constitute final acceptance of equipment.

- F. Furnish covered, weather-protected storage structures providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, architectural items, electrical and instrumentation equipment and special equipment to be incorporated into this project.
 - 1. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc.
 - 2. The Contractor shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials.
 - 3. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project.
 - 4. Equipment and materials not properly stored will not be included in an application for payment.

- G. Store products with seals and legible labels intact.

- H. Store moisture sensitive products in weathertight enclosures.

- I. Maintain products within temperature and humidity ranges required or recommended by manufacturer.

- J. Maintain storage areas at ambient temperatures recommended by manufacturer.
- K. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Repaint damaged painted surfaces. Contractor shall store all products in a manner to prevent surface oxidation (rust).
- L. Exterior storage of fabricated products:
 - 1. Place on aboveground supports that allow for drainage.
 - 2. Cover products subject to deterioration with impervious sheet covering.
 - 3. Provide ventilation to prevent condensation under covering.
- M. Store loose granular materials on solid surfaces in well-drained area. Prevent materials mixing with foreign matter.
- N. Provide access for inspection.
- O. Maintain equipment per the manufacturer's recommendation and industry standards, including oil changes, rotation, etc. Provide a log of equipment maintenance to the Engineer and Plant Superintendent on a monthly basis.
 - 1. Rotation log shall include, as a minimum, the equipment identification, date stored, date removed from storage, copy of manufacturer's recommended storage guidelines, date of rotation of equipment, and signature of party performing rotation.
- P. Protection after installation:
 - 1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

1.08 MANUFACTURER'S INSTRUCTIONS

- A. Deliver, handle, store, install, erect, or apply products in accordance with manufacturer's instructions, Contract Documents, and industry standards.
- B. Periodically inspect to assure products are undamaged and maintained under required conditions.
- C. Provide operations and maintenance manuals as specified in Section 01782:
 - 1. Draft versions submitted prior to equipment shipment to project.
 - 2. Final version submitted and accepted no later than 60 days prior to Owner training.

1.09 SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS

- A. Provide spare parts, maintenance products, and special tools as required by Specifications.
- B. Box, tag, and clearly mark items.
- C. Store spare parts, maintenance products, and special tools in enclosed, weather-proof, and lighted facility during the construction period.
 - 1. Contractor is responsible for spare parts and special tools until acceptance by Owner.

2. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.

PART 2 PRODUCTS

2.01 SPARE PARTS AND SPECIAL TOOLS

- A. Spare parts and special tools inventory list, see Attachment No. 1:
 1. Equipment tag number.
 2. Equipment manufacturer.
 3. Subassembly component, if appropriate.
 4. Quantity.
 5. Storage location.

- B. Large items:
 1. Weight: Greater than 50 pounds.
 2. Size: Greater than 24 inches wide by 18 inches high by 36 inches long.
 3. Stored individually.
 4. Clearly labeled:
 - a. Equipment tag number.
 - b. Equipment manufacturer.
 - c. Subassembly component, if appropriate.

- C. Smaller items:
 1. Weight: Less than 50 pounds.
 2. Size: Less than 24 inches wide by 18 inches high by 36 inches long.
 3. Stored in spare parts box.
 4. Clearly labeled:
 - a. Equipment tag number.
 - b. Equipment manufacturer.
 - c. Subassembly component, if appropriate.

- D. Spare parts and special tools box:
 1. Wooden box:
 - a. Size: 24 inches wide by 18 inches high by 36 inches long.
 2. Hinged wooden cover:
 - a. Strap type hinges.
 - b. Locking hasp.
 - c. Spare parts inventory list taped to underside of cover.
 3. Coating: As specified in Section 09960.
 4. Clearly labeled:
 - a. The words "Spare Parts and/or Special Tools."
 - b. Equipment tag number.
 - c. Equipment manufacturer.

PART 3 EXECUTION

3.01 COMMISSIONING AND PROCESS START-UP

- A. As specified in Section 01756.

3.02 CLOSEOUT ACTIVITIES

- A. Owner may request advanced delivery of spare parts and special tools.
 - 1. Deduct the delivered items from inventory and provide transmittal documentation.
- B. Immediately prior to the date of Substantial Completion, arrange to deliver spare parts and special tools to Owner (Plant Superintendent) at a location on site chosen by the Owner.
 - 1. Provide itemized list of spare parts and special tools that matches the identification tag attached to each item.
 - 2. Owner (Plant Superintendent) and Engineer will review the inventory and the itemized list to confirm it is complete and in good condition prior to signing for acceptance.

3.03 ACCESS BY THE CONTRACTOR, SUBCONTRACTORS, AND ALL REPRESENTATIVES TO THE WESTSIDE REGIONAL WATER RECLAMATION FACILITY

- A. Plant Superintendent should receive a list of all personnel to be admitted to the Facility.
- B. Plant Superintendent will get this list to the guard.
- C. Guard is on duty Monday through Friday from 0630 to 1630 hours.
- D. If under special circumstances the Contractor and/or their subcontractors need access to the Facility that access must be granted by the Superintendent.
- E. Plant Superintendent will give special instructions as to how to access the Facility once permission is granted.

3.04 ATTACHMENTS

- A. Attachment No. 1 - Spare Parts and Special Tools Inventory List.
- B. Attachment No. 2 - Sample Substitution Request Form.

END OF SECTION

Attachment No. 1
SPARE PARTS AND SPECIAL TOOLS INVENTORY LIST

[Specification Number and Title]				
[Equipment Tag Number]				
[Equipment Manufacturer]				
Quantity	Subassembly Component	Description	Manufacturer's Part Number	Storage Location

Attachment No. 2

Sample Substitution Request Form

Project: _____ Substitution Request Number: _____

 From: _____
 To: _____ Date: _____

 Engineer Project Number: _____
 Re: _____ Contract For: _____

Specification Title: _____ Description: _____
 Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
 Manufacturer: _____ Address: _____ Phone: _____
 Trade Name: _____ Model No.: _____
 Installer: _____ Address: _____ Phone: _____
 History: New product 2-5 years old 5-10 yrs old More than 10 years old
 Differences between proposed substitution and specified product: _____

Point-by-point comparative data attached - REQUIRED BY ENGINEER

Reason for not providing specified item: _____

Similar Installation:
 Project: _____ Architect: _____
 Address: _____ Owner: _____
 _____ Date Installed: _____

Proposed substitution affects other parts of Work: No Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: No Yes [Add] [Deduct] _____ days.

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
 - Same warranty will be furnished for proposed substitution as for specified product.
 - Same maintenance service and source of replacement parts, as applicable, is available.
 - Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
 - Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
 - Proposed substitution does not affect dimensions and functional clearances.
 - Payment will be made for changes to building design, including Engineer design, detailing, and construction costs caused by the substitution.
 - Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.
-

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

ENGINEER'S REVIEW AND ACTION

- Substitution accepted - Make submittals in accordance with Specification Section 01330.
- Substitution accepted as noted - Make submittals in accordance with Specification Section 01330
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by:

Date:

Additional Comments: Contractor Subcontractor Supplier Manufacturer Engineer _____

SECTION 01610

PROJECT DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Project design criteria such as temperature and site elevation.

1.02 PROJECT DESIGN CRITERIA

- A. All equipment and materials for the project are to be suitable for performance in domestic water treatment plant environment and under following conditions:
 - 1. Design temperatures are:
 - a. Outdoor temperatures: 0 to 100 degrees Fahrenheit.
 - 2. Design groundwater elevation: 3 feet below grade.
 - 3. Moisture conditions: Defined in individual equipment sections.
 - 4. Site elevation: Approximately 30 feet above mean sea level.
 - 5. Wind Design Criteria - As noted on Structural Drawings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01710

PROJECT HOUSEKEEPING/CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Maintain construction cleanliness during progress of Work and perform final cleaning at completion of the Work, and as required by conditions of the Contract. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
- B. Materials
 - 1. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
 - 2. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
 - 3. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute daily cleaning to keep the Work, the site, access ways, access roads, free from accumulation of waste materials, rubbish, and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish containers must be emptied daily or as frequently as necessary to contain disposals.
- C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal disposal areas away from the site.
- D. Schedule operations so that dust and other contaminants resulting from cleaning process shall not fall on wet or newly created surfaces.
- E. Under no circumstances will the Contractor and subcontractors bury any waste, debris and other unsuitable material on-site or as part of site work such as pipe trench fill back etc.

3.02 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
- C. Prior to final inspection, or City occupancy, Contractor shall conduct an inspection of all work areas, to verify that the entire Work is clean.

END OF SECTION

SECTION 01720

AS-BUILTS/RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section sets forth the requirements for preparing as-built/record drawings and documents for verification of construction and archiving for future use. Contractor shall secure the services of a Florida licensed surveyor to collect data and prepare as-built/record drawings.

1.02 REFERENCE

- A. The preparation work shall be in accordance with this Section and supplementary details in the City of Daytona Beach Utilities Department (Owner) Standard Details, latest edition.

1.03 AS-BUILT/RECORD DRAWINGS

- A. As-built/record drawings are required for all public facilities constructed. Prior to construction completion these as-built/record requirements will be reviewed to be certain the Contractor's surveyor has a clear understanding of what is required for completion of this work.
- B. In order to ensure that the Owner's project records are maintained to the highest standards and the information can easily be added to the Owner's electronic records the following information is required on all as-built/record drawings:
 1. Pavement and curb widths shall be verified and dimensioned for each street at each block (for subdivisions) and as appropriate to confirm paving limits (on site plans).
 2. All radii at intersections shall be verified and dimensioned. This information is to be clearly indicated on the as-built/record drawings.
 3. Roadway elevations shall be recorded at all grade changes, 100 foot intervals along roadway, and other intervals as needed along all streets. Street centerline and curb invert elevations shall be recorded as noted.
 4. The as-built centerline profile of all streets shall also be shown on the plan and profile so it may be compared to the design profile grade lines. In the event that the as-built centerline longitudinal grade does not meet the Owner's minimum standards, additional longitudinal grades of the adjacent curbing and similar roadway cross-section surveys to verify the correct cross slope, shall be required to verify that the system will function as originally designed.
 5. Storm drainage structures shall be located and/or dimensioned from centerlines or lot lines as appropriate. Each structure shall be located by sub-meter GPS with latitude, longitude and elevation data.
 6. Storm drainage pipe invert and inlet elevations shall be recorded and clearly denoted as as-built information. Design elevations shall be crossed out and as-built information written next to it.

7. Storm drainage pipe material, length, and size shall be measured and/or verified. This information is to be clearly indicated as being as-built information.
8. All applicable topographic information pertinent to the on-site drainage system, such as ditches, swales, lakes, canals, etc. that are deemed necessary by the Owner to verify the functional performance of the storm water system, shall be noted. Normally, recording elevations every 100 feet at the top of bank and toe of slope will be required. Measurements shall be taken and recorded in order to accurately tie down these features to the roadway centerlines and to plat lines. Whenever possible, contour lines shall be utilized to graphically describe these topographic features.
9. Retention areas shall have their top of bank and bottom elevations recorded. Actual measurements shall be taken and dimensions recorded of the size of all retention areas. Measurements shall be done from top of bank with side slopes indicated. Separate calculations shall be submitted to indicate required and provided retention volumes.
10. Actual materials used and elevations and dimensions of overflow weir structures and skimmers shall be noted on the as-built.
11. Storm drainage swale centerlines shall be located and elevations of flow line and top of bank shall be recorded every 100 feet. Side slopes shall also be indicated.
12. Sanitary sewer manholes shall be verified and dimensioned from street centerlines or lot lines as appropriate. All rim and invert elevations shall be verified and recorded. This information shall be clearly indicated as being as-built information. Design Elevations shall be crossed out and as-built information written next to it.
13. For subdivisions, proposed design finish floor elevations shall appear on all subdivision lots on the appropriate plan and profile sheet as well as on the master drainage plan.
14. Sanitary Sewer line lengths, sizes, material, slope, etc., shall be verified and recorded, this information is to be clearly indicated as being as-built information.
15. Sewer Laterals shall be verified and recorded at their clean out locations, stationing and offset distances shall be measured from downstream manholes towards upstream manholes. Invert information at cleanout shall be provided, and be located by sub-meter GPS with latitude, longitude and elevation data
16. Lift stations and force mains shall be verified and dimensioned from street centerlines or lot lines as appropriate. Force main depth and location including valves will be provided and tied to permanent above grade features. Dimensional and elevation information indicated on the approved plan shall be verified and recorded. This information shall be clearly indicated as being as-built information. Buried potable water lines and electrical service lines shall be clearly dimensioned, located, and labeled. Each lift station shall be located by sub-meter GPS with latitude, longitude, and elevation data provided.
17. Curb cuts or metal tabs, used to mark sewer laterals, water services and water valves, shall be verified for presence and accuracy of location.
18. Potable and reclaimed water main lines shall be dimensioned off the baseline construction. Water main line material size, length and depth placed shall be noted. Locations of valves shall also be tied to baseline construction. This information shall be clearly indicated as being as-built information.

19. Potable and reclaimed water valves, tees, bends, all services, and fire hydrants shall be located by tying them to baseline construction (Sta. & Offset). Similarly, force main valves, tees, and bends shall be located in the same manner. Stationing and offset distances shall be measured from downstream manholes to upstream manholes. All valves and hydrants shall be located by sub-meter GPS with latitude, longitude, and elevation data provided.
20. For perpendicular crossings of storm water, sanitary sewer, potable water, or reclaimed water, the as-built plans shall clearly indicate which utilities are located over or under other utilities, as necessary.
21. Any special features such as, concrete flumes, lake banks, walls, fencing, etc. which are a part of the approved construction drawings should also be located and dimensioned.
22. If an approved subdivision plat or site plan shows a conservation easement, the project surveyor should provide the exact location of the specimen tree(s) from the right-of-way or property lines and proposed easement boundaries on the as-built drawing. The as-built location of these trees will help verify the sufficiency of the conservation easement prior to plat recording or certificate of occupancy.
23. When storm water, potable water, reclaimed water, or sanitary sewer improvements are located within an easement, the as-built drawing will accurately depict the location of the easement itself as well as the exact location of the improvements within the easement. This is required in order to verify that the improvements have been properly located and to ensure that future subsurface excavation to perform remedial repair can be accomplished without disturbance beyond the easement.
24. As-built drawings are to be prepared by a Florida licensed surveyor and shall include a signed certification statement by the Florida licensed engineer of record. A Mylar set of as-built record drawings shall be provided with a digital copy in a compatible AutoCAD format.
25. Elevations shall be referenced to NGVD 1988 Data. As-built survey information shall be referenced to at least two Florida State Plane east coordinates NAD 83.
26. Benchmark Datum utilizes monumentation from the North American Vertical Datum (NAVD) of 1929 with elevations adjusted to NGVD 1988 data. Any NAVD 1929 monument with the limits of construction is to be protected.

1.04 SUBMITTALS

- A. The CONTRACTOR shall require the Surveyor and Mapper to locate all improvements for the Project As-Built Survey using State Plane Coordinates and the vertical datum referenced on the Drawings. The CONTRACTOR shall obtain an electronic copy of the Drawings from the CITY for use as a base for the As-Built Survey. The As-Built Survey shall clearly show the designed and constructed locations and elevations information for ease of comparison. This shall be accomplished by adding the As-Built information on a separate CAD level or layer, while keeping all the design call-outs and construct requirements visible. The As-Built information shall be labeled as such and be shown with a bolder text weight in order to be easily identifiable. The As-Built Survey shall include all storm and sanitary sewers and structures, clean-outs, potable and reclaimed water mains, meters, valves, force mains, gas mains, irrigation lines (2-inch and larger), process piping, electric and communication duct banks, traffic and pedestrian signals, pull

boxes, cabinets, transformers, structures, drainage conveyance systems, retention ponds, fences, pavement, curbs, sidewalks, driveways, relocated utilities, appurtenances and buildings. All planned improvements referenced by station and offset on the Plans, shall also be referenced on the As-Built Survey in the same manner. All constructed improvements that have location and/or elevation information called-out on the Plans, shall have the same information identified on the As-Built Survey. If a structure information table was provided on the Plans, then the As-Built information shall be shown in the table. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible. Pavement and drainage flowline elevation shots shall be taken at minimum 25' intervals and grade breaks. As-Built Survey shots shall be taken at the same locations as shown on the Plans for ease of comparison. Any variations from required material sizes or types shall also be noted.

- B. The CONTRACTOR shall submit a copy of the current monthly updated As-Built Survey ("Progressive As-Built Survey") signed and sealed on each page and also submit identically matching electronic files in PDF format and the same CAD file format as the original design. The Progressive As-Built Survey shall be submitted to the City and Engineer with each Application for Payment and indicate the horizontal and vertical locations of all constructed improvements to date with sufficient information and notes to easily determine if the improvements were constructed in conformance with the Contract Documents. The Progressive As-Built Survey submittals shall include a cover sheet and include the surveyor's statement regarding the constructed improvements being within the specified tolerances or if not indicating the variances, as described above in paragraph II.B.3. The CONTRACTOR's submission of a Progressive As-Built Survey or Final As-Built Survey, as applicable, acceptable to the City, with its Application for Payment, is a condition precedent to the ENGINEER's payment recommendation to the City. If no construction has been performed during the period, the Contractor shall provide documentation of such in accordance with the requirements of the Engineer.
- C. The Contractor shall submit a minimum of three (3) signed and sealed sets of the final As-Built Survey incorporating all Work performed under the Contract Documents ("Final As-Built Survey") with the Application for Final Payment, as well as identically matching electronic files in PDF format, Mylar, and the same CAD file format as the original design (AutoCAD). See 3.01 D below for more details on final submittal. Electronic file submittals that have more than one file or a file for each plan sheet shall have an index and/or a logical filename containing a description of the file's contents. The final conformed Drawings shall be used as the basis for the As-Built Survey. The sets shall be in design plan format containing a complete set of all of the original plan sheets. The Surveyor and Mapper shall only sign and seal those sheets containing As-Built Survey information. Failure to provide accurate survey information in the proper format requested may result in the CITY determining the As-Built Survey is incomplete. In general as-built survey/drawings should be as follows:
1. As-built drawings/surveys should be "Progressive as-built" submitted monthly with the pay applications. Contractor shall allow sufficient time to coordinate and approval of the City and Engineer of Record on the format and content of the "Progressive as-built" drawings before submitting them as part of the pay applications.

2. As-built drawings/surveys should show all constructed components and note deviations made from the design (as shown on conformed drawings). Such deviations shall be noted with a reference to the RFIs or field change directive or any other reason resulting in the change. This reference should be identified in the title block under the revisions block. A unique identifier number shall be put on the drawing with the description of the reference in the title block.
 3. As-builts shall show all electrical duct banks (including the size, top elevation and grade elevation along the duct bank every 10-ft interval). All changes in direction and elevation of the duct bank shall be specifically called out and shown on the as-builts.
 4. As-builts shall show all piping and fittings (including size, top elevation and grade elevation along the pipe every 10-ft interval). All changes in direction and elevation of the pipe shall be specifically called out and shown on the as-builts.
 5. As-builts shall show all piping, fittings, valves, pipe supports, electrical conduits or duct banks, and all equipment as installed both inside existing and new structures and outside in the field (above and below grade).
- D. At Final Completion of the Project, the Contractor shall submit field mark-up drawings showing all other constructed improvements not included in the As-Built Survey as required above. This includes improvements such as, but not limited to, irrigation lines smaller than 2-inch, sprinkler heads, miscellaneous wiring, site furnishings and traffic control loops, and only applies to variations from what is shown on the Drawings. These mark-up drawings shall be compiled on a clean set of the original Drawings.
- E. If unidentified utilities (not shown on the Drawings) are encountered during the installation of the Work, their horizontal and vertical location shall be included in the As-Built Survey. Provide the name and type of utility, the size and material type of pipe, conduit or structure and if known, the status (active or inactive) of the utility.
- F. The Contractor shall submit documentation to verify the accuracy of field surveying work at the request of the Engineer or City.
- G. Contractor shall submit Record Drawings on CD and Mylar. When the As-Builts are delivered for clearance of water lines (two paper copies), they will be scheduled for chlorination. Owner will not release the drinking water bacteriological laboratory report to Volusia County Health Department until the As-built information meets Owner requirements. Contractor will have 60 days from the time that the bacteriological samples are collected to submit the as-built Mylar and CD to City. Send the two paper copies for approval before making the Mylar. If Contractor goes past the 60 days re-chlorination will be required and pay for the bacteriological laboratory report will be required. Below are minimum detail samples of how the As-Built drawing information will need to be presented

- H. These are examples of how to display and label valves, fittings, and pipes on the plans. Include a location arrow pointing to the identified object:

Valve Example:

20" GATE VALVE
STA. 22+33 (LT.55.0')
LAT. = 29°12'53.009"N
LONG. = 81°04'03.355"W
N = 1,774,373.4058
E = 634,602.7566
TOP ELEV. = 27.50
FINISH GROUND ELEV. = 30.50

Pipe Example:

20" DIP WATER MAIN
STA. 22+00 (RT.55.0')
LAT. = 29°12'50.009"N
LONG. = 81°04'26.355"W
N = 1,774,373.4058
E = 634,602.7566
TOP OF PIPE ELEV. = 27.50
FINISH GROUND ELEV. = 30.50

(All Bench Marks used must be shown on the plans)

Bench Mark Example:

BM#13
STA. 20+33 (LT. 85.5')
3/4" Iron Rod with Plastic Cap...
N = 1,774,373.4058
E = 634,602.7566
LAT. = 29°04'53.355" W
LONG. = 81°04'53.355" W
ELEV. = 32.55

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 GENERAL

- A. All drawings shall be prepared to True State Plane Coordinates. Contractor shall provide all materials, equipment, labor needed to prepare and submit accurate As-Built/Record Drawings.
- B. It is acceptable to the City if the surveyor utilizes an after the fact approach to collecting and verifying the location and depth by vertical PVC pipes placed by the Contractor as markers for this purpose. The surveyor shall verify to the accuracy defined in Florida Statutes the As-Built conditions and certify the Record Drawings.

- C. City shall not be considered the best source of information for valve locations that may have been lost during final grading, the surveyor or Contractor shall excavate and properly mark all valve boxes and each valve shall have a tag or color coded to define water, sewer or reuse water valves. The use of temporary PVC pipe markers color coded is acceptable so long as cross references are provided on the Record Drawings to prevent the tops from a water valve being placed on a sewer valve.
- D. The Contractor shall provide the utilities department engineering division the final as-built/record drawings on cd and mylar. The as-built record drawings shall be prepared using autocad format 2010 or later. In model space the drawing shall be in fl83-ef state plane coordinates and shall be able to be inserted into the owner's overall gis system. The record drawings shall also be printed on mylar signed and sealed as allowed by state of florida regulations. A disclaimer may be noted in a transmittal letter plus the surveyor may add a special notice on each sheet regarding the location of the true original record drawings or place limits on responsibility should sometime in the future someone need to modify the mylars.
- E. Identify the source markers for the survey used for Record Drawings.

END OF SECTION

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SECTION 01756

TESTING, TRAINING, AND FACILITY START-UP

PART 1 GENERAL

1.01 SUMMARY

- A. The work specified in this SECTION consists of start-up and final check out of Mechanical, Electrical, Communications, Pneumatic, Hydraulic, Conveyance or Special Construction or any other discipline as called for by the technical specifications of the Contract Documents. These systems (heating, ventilating, air conditioning, plumbing, fire protection systems, HVAC and control system, communications and alarm systems, lighting, power distribution, controls, and other electrical systems and elevators) and other operating equipment as required; will be demonstrated, to ENGINEER, to operate in the manner prescribed by the Contract Documents to ensure a complete operating system, ready for City of Daytona Beach Utilities Department (OWNER) use.
- B. Section includes: Requirements for equipment and system testing and facility start-up, including the following:
 - 1. Start-up plan.
 - 2. Performance testing.
 - 3. General start-up and testing procedures.
 - 4. Functional testing.
 - 5. Operational testing.
 - 6. Certificate of proper installation.
 - 7. Services of manufacturer's representatives.
 - 8. Training of Owner's personnel.
- C. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 15050 - Common Work Results for Mechanical Equipment.

1.02 DEFINITIONS

- A. Commissioning - The process of planning, testing, and process start-up of the installation for compliance with contract requirements and demonstrating, through documented verification, that the project has successfully met the Contractual requirements. It includes training the Owner's staff to operate the facility.

- B. Commissioning Phases - The work activities of facility commissioning are grouped into the phases defined in the table below.

Commissioning		
Planning Phase	Testing and Training Phase	Process Start-Up Phase
Owner Training Plan and Schedule	Source Testing	Process Start-up
Commissioning Schedule	Owner Training	Process Operational Period
Subsystem Testing Plan	Installation Testing	Instrumentation and Controls Fine-Tuning
Clean Water Facility Testing Plan	Functional Testing	
	Clean Water Facility Testing	
	Closeout Documentation	

- C. Component - A basic building block of equipment, subsystems, and systems that requires installation or functional testing but does not have an electrical connection or internal electronics. (Examples: filter effluent piping and manual isolation valves).
- D. Device - A basic building block of equipment, subsystems, and systems that requires installation or functional testing and does have an electrical connection or internal electronics. (Examples: filter level transmitter or water pump pressure transmitter).
- E. Equipment - An assembly of component(s) and devices(s) that requires installation or functional testing. (Examples: Pump, motor, VFD, Mechanical Surface Aerators, RAS/WAS Pumps, etc.).
- F. Facility - A grouping of process areas, systems, subsystems, equipment, components, and devices (Examples: treatment plant, pump station, etc.).
- G. Functional Testing - Testing performed on a completed subsystem to demonstrate that equipment/system meets manufacturers' calibration and adjustment requirements and other requirements as specified. Functional testing includes operating equipment/system manually in local, manually in remote (or remote manual), and automatically in remote (in remote auto).
- H. Installation Testing - Testing to demonstrate that subsystem component (piping, power, networks, devices, etc.) is ready and meets the project requirements in advance of functional testing. Installation testing also includes manufacturers' certification of installation and other requirements as specified to prepare equipment/system for Functional Testing. Also referred to as Field Acceptance Testing.

- I. Manufacturer's Certificate of Source Testing - When applicable, the form is used during Source Testing for the manufacturer to confirm that the applicable source tests have been performed and results conform to the Contract Documents. The form is provided at the end of this Section.
- J. Manufacturer's Certificate of Installation and Functionality Compliance - The form is used during Installation Testing and Functional Testing. It is submitted at the end of Functional Testing to confirm that the equipment/system is installed in conformance with the Contract Documents and that it meets the Functional Testing requirements defined in the Contract Documents. The form is provided at the end of this Section.
- K. Process Area - A grouping of systems, subsystems, equipment, components, and devices that divide a facility into functional areas. (Examples: Filter Process Area).
- L. Process Operational Period - A period of time after completion of the process start-up set aside for final Operational Testing to verify facility performance meets the Contract Document requirements. This period may specifically limit other construction activities.
- M. Process Start-up Phase - Operating the facility to verify performance meets the Contract Document requirements.
- N. Process Start-Up - Activities conducted after the testing and training phase that are necessary to place systems or process areas into operational service.
- O. Product - A system, subsystem, or component.
- P. Subsystem - A building block of systems made up from a grouping of components, devices, and equipment that perform a definable function. (Examples: Filter No. 1).
- Q. System - A grouping of subsystems, equipment, components, and devices that perform a definable function. (Examples: Filter No. 1, RAS Pumping).

1.03 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

- A. Contract requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.
- B. Complete testing, training, and start-up within the Contract Times.
- C. Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.
- D. Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.
- E. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

1.04 START-UP PLAN

- A. Contractor with input from relevant equipment manufacturer(s) shall submit start-up plan for each piece of equipment and each system not less than 3 weeks prior to planned initial start-up of equipment or system.
- B. Provide detailed sub-network of Progress Schedule with the following activities identified:
 - 1. Manufacturer's services.
 - 2. Installation certifications.
 - 3. Operator training.
 - 4. Submission of Operation and Maintenance Manual.
 - 5. Functional testing.
 - 6. Performance testing.
 - 7. Operational testing.
- C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.
- D. Provide summary of shutdown requirements for existing systems that are necessary to complete start-up of new equipment and systems.
- E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.05 PERFORMANCE TESTING

- A. Test equipment for proper performance at point of manufacture or assembly when specified.
- B. When source quality control testing is specified:
 - 1. Demonstrate equipment meets specified performance requirements.
 - 2. Provide certified copies of test results.
 - 3. Do not ship equipment until certified copies have received written acceptance from Engineer. Written acceptance does not constitute final acceptance.
 - 4. Perform testing as specified in the equipment sections.

1.06 GENERAL START-UP AND TESTING PROCEDURES

- A. Performed by Contractor under direction / supervision of Manufacturer's Representative/Technician.
- B. Mechanical systems: As specified in the individual equipment Sections and Sections 15050:
 - 1. Remove rust preventatives and oils applied to protect equipment during construction.
 - 2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
 - 3. Flush fuel system and provide fuel for testing and start-up.
 - 4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.

5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
7. Perform cold alignment and hot alignment to manufacturer's tolerances.
8. Adjust V-belt tension and variable pitch sheaves.
9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
11. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.

C. Electrical systems: See Division 16 specifications.

D. Instrumentation systems: See Division 17 specifications.

1.07 FUNCTIONAL TESTING

- A. Perform checkout and performance testing as specified in the individual equipment Sections (Performed by Contractor under direction / supervision of Manufacturer's Representative / Technician).
- B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.
- C. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
- D. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation, and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.
- E. Conduct continuous 8-hour test under full load conditions. Replace parts that operate improperly.

1.08 OPERATIONAL TESTING

- A. After completion of operator training, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation. (Performed by Contractor under direction / supervision of Manufacturer's Representative / Technician).
- B. Conduct operational test for continuous 7-day period.
- C. Owner will provide operations personnel, power, fuel, and other consumables for duration of test.

- D. Immediately correct defects in material, workmanship, or equipment that became evident during operational test.
- E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.09 CERTIFICATE OF PROPER INSTALLATION

- A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:
 - 1. Has been properly installed, adjusted, aligned, and lubricated.
 - 2. Is free of any stresses imposed by connecting piping or anchor bolts.
 - 3. Is suitable for satisfactory full-time operation under full load conditions.
 - 4. Operates within the allowable limits for vibration.
 - 5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
 - 6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.
- B. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:
 - 1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
 - 2. Control logic for equipment start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 3. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.10 SERVICES OF MANUFACTURER'S REPRESENTATIVES

- A. Qualification of manufacturer's representative as specified in the Contract Documents technical Sections include the following:
 - 1. Authorized representative of the manufacturer, factory trained and experienced in the technical applications, installation, operation, and maintenance of respective equipment/system with full authority by the equipment/system manufacturer to issue the certifications required of the manufacturer.
 - 2. Competent, experienced technical representative of equipment/system manufacturer for assembly, installation, testing guidance, and training.
 - 3. Additional qualifications may be specified in the individual Sections.
 - 4. Submit qualifications of the manufacturer's representative no later than 30 days in advance of required observations.
 - 5. Representative subject to approval by Owner and Engineer.
 - 6. No substitute representatives will be allowed until written approval by Owner and Engineer has been obtained.
- B. Completion of manufacturer on-site services: Engineer approval required.

- C. Manufacturer is responsible for determining the time required to perform the specified services.
 - 1. Minimum times specified in the Contract Documents are estimates.
 - 2. No additional costs associated with performing the required services will be approved.
 - 3. Manufacturer required to schedule services in accordance with the Contractor's project schedule up to and including making multiple trips to project site when there are separate milestones associated with installation of each occurrence of manufacturer's equipment.
- D. Manufacturer's on-site services as specified in the Contract Documents include the following:
 - 1. Assistance during Commissioning Phase and Process Start-Up Phase.
 - 2. Provide daily copies of manufacturer's representative's field notes and data to Engineer.
 - 3. Other requirements as specified in the Contract Documents.

1.11 TRAINING OF OWNER'S PERSONNEL

- A. Provide operations and maintenance training for items of mechanical, electrical, and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.
- B. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than 2 sessions per week.
- C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 1 month prior to training session for that piece of equipment or system.
- D. Satisfactorily complete functional testing before beginning operator training.
- E. Training should be relevant and useful for the subject matter and should include a standard operating procedure (SOP) customized to the requirements of the Plan including a section on trouble shooting of the equipment. Coordinate with Engineer to prepare a detailed SOP to meet the requirements of the staff. Engineer will coordinate with Plant Superintendent appropriately.
- F. All training will be scheduled from 7:00 am to 3:30 pm with at least a half hour uninterrupted lunch period. To cover all shifts, personnel training shall be done in two separate sessions. All scheduling of training sessions will be with the approval of the Owner.
- G. Training sessions: Provide training sessions for equipment as specified in the individual equipment Sections.
- H. The Contractor shall videotape all training sessions and provide a copy for the Owner.
- I. The Contractor shall designate and provide 1 or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the Owner.

- J. The Contractor's coordinator shall coordinate the training periods with Owner personnel and manufacturer's representatives, and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation. Coordinate with Plant Superintendent for training periods.

1.12 RECORD KEEPING

- A. Contractor shall maintain and submit following records generated during start-up and testing phase of Project:
 - 1. Daily logs of equipment testing identifying all tests conducted and outcome.
 - 2. Logs of time spent by manufacturer's representatives performing services on the job site.
 - 3. Equipment lubrication records.
 - 4. Electrical phase, voltage, and amperage measurements.
 - 5. Insulation resistance measurements.
 - 6. Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.
- B. Contractor shall provide copy of these records to Owner's representative (Plant Superintendent) at Substantial Completion.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF SOURCE TESTING

OWNER _____ EQPT/SYSTEM _____
PROJECT NAME _____ EQPT TAG NO. _____
PROJECT NO. _____ EQPT SERIAL NO. _____
SPECIFICATION NO. _____
SPECIFICATION TITLE _____

Comments: _____

I hereby certify Source Testing has been performed on the above-referenced equipment/system as defined in the Contract Documents, and results conform to the Contract Document requirements. Testing data is attached.

Date of Execution: _____, 20____

Manufacturer: _____

Manufacturer's Authorized Representative Name (*print*): _____

(Authorized Signature)

If applicable, Witness Name (*print*): _____

(Witness Signature)

**MANUFACTURER'S CERTIFICATE OF
INSTALLATION AND FUNCTIONALITY COMPLIANCE**

OWNER _____ EQPT/SYSTEM _____
PROJECT NAME _____ EQPT TAG NO. _____
PROJECT NO. _____ EQPT SERIAL NO. _____
SPECIFICATION NO. _____
SPECIFICATION TITLE _____

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/instrumentation and mechanical connections meet quality and safety standards.
- All applicable safety equipment has been properly installed.
- Functionally tested.
- System has been performance tested, and meets or exceeds specified performance requirements.

NOTES:

Attach test results with collected data and test report.

Attach written certification report prepared by and signed by the electrical and/or instrumentation subcontractor.

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 this equipment/system, and (iii) authorized to make recommendations required to ensure that the equipment/system 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: _____

Manufacturer's Authorized Representative Name (*print*): _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

MANUFACTURER'S CHECK CERTIFICATION

	CITY OF DAYTONA BEACH		NO. OF COPIES
	ENGINEER		NO. OF COPIES
	DESIGN ENGINEER		NO. OF COPIES
	CONTRACTOR		NO. OF COPIES
	FIELD		NO. OF COPIES
	OTHER		NO. OF COPIES

PROJECT DATA AND CONTRACT DATA

NAME OF PROJECT: WEST SIDE REGIONAL WRF IMPROVEMENTS

PROJECT NUMBER:

LOCATION: _____ DATE: _____

CITY: _____ DRAWING NO.: _____

OTHER: _____

SYSTEM DESCRIPTION: _____

Name of equipment checked:

Name of manufacturer or equipment:

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

MANUFACTURER'S CHECK CERTIFICATION SIGNATURE PAGE

	MANUFACTURER	CONTRACTOR	SUBCONTRACTOR
Checked By:			
Address and Phone:			
Authorized Signature:			
Date:			

Manufacturer's Representative Notations: Exception noted at time of check were:

Manufacturer's Representative to note adequacy of related equipment that directly affects operation, performance, or function of equipment checked. (No comment presented herein will indicate adequacy of related systems or equipment):

DEMONSTRATION/START-UP CERTIFICATION

	CITY OF DAYTONA BEACH		NO. OF COPIES
	ENGINEER		NO. OF COPIES
	DESIGN ENGINEER		NO. OF COPIES
	CONTRACTOR		NO. OF COPIES
	FIELD		NO. OF COPIES
	OTHER		NO. OF COPIES

PROJECT DATA AND CONTRACT DATA

NAME OF PROJECT: WESTSIDE REGIONAL WRF IMPROVEMENTS

PROJECT NUMBER:

LOCATION: _____ DATE: _____

CITY: _____ DRAWING NO.: _____

OTHER: _____

SYSTEM DESCRIPTION: _____

Note to Contractor:

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

MEMORANDUM:

This memo is for the information of all concerned that the Owner has been given a start-up demonstration on the system described above. This start-up demonstration consisted of the system operation, during which all major items of equipment were explained and demonstrated, and the following items were given to the Owner:

- a. Owner's copy of Operation and Maintenance manual for the system containing approved submittal sheets on all items, including the following:
 - Maintenance information published by manufacturer on equipment items.
 - Printed warranties by manufacturers on equipment items.
 - Performance verification information as recorded by Contractor.
 - Check-out Memo on equipment by Manufacturer's representative.
 - Written operating instructions on any specialized items.
 - Explanation of warranties and guarantees on the system.
- b. Prints showing actual "as-built" conditions.

- c. A demonstration of the system in operation and of the maintenance procedures which will be required.

NAME OF CONTRACTOR: _____

BY: _____
(Authorized Signature, Title, & Date)

NAME OF SUBCONTRACTOR: _____

BY: _____
(Authorized Signature, Title, & Date)

Operation and Maintenance Manual, Instruction Prints, Start-up Demonstration and Instruction in Operation Received:

(CITY OF DAYTONA BEACH)

BY: _____
(Authorized Signature, Title, & Date)

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Contract closeout requirements including:
 - 1. Final cleaning.
 - 2. Waste disposal.
 - 3. Touch-up and repair.
 - 4. Disinfection of systems.
 - 5. Preparation and submittal of closeout documents.
 - 6. Final completion certification.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01324B - Progress Schedules and Reports.

1.02 REFERENCES

- A. American Water Works Association (AWWA).

1.03 FINAL CLEANING

- A. Perform final cleaning prior to inspections for Substantial Completion and Final Acceptance.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned. Do not use City's cleaning supplies. Remove used cleaning chemicals and supplies at the end of the project.
- D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
- E. Clean roofs, gutters, downspouts, and drainage systems.
- F. Broom clean exterior paved surfaces and rake clean other surfaces of site work.
- G. Remove dust, cobwebs, and traces of insects and dirt.

- H. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.
- I. Remove non-permanent protection and labels.
- J. Polish waxed woodwork and finish hardware.
- K. Wash tile.
- L. Wax and buff hard floors, as applicable.
- M. Wash and polish glass, inside and outside.
- N. Wash and shine mirrors.
- O. Polish glossy surfaces to clear shine.
- P. Vacuum carpeted and soft surfaces.
- Q. Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.
- R. Clean ducts, blowers, and coils when units were operated without filters during construction.
- S. Clean light fixtures and replace burned-out or dim lamps.

1.04 WASTE DISPOSAL

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site:
 - 1. Prior to making disposal on private property, obtain written permission from City of such property.
- B. Do not fill ditches, washes, or drainage ways which may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to final acceptance of the Work.

1.05 TOUCH-UP AND REPAIR

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Substantial Completion.
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

1.06 CLOSEOUT DOCUMENTS

- A. Submit following Closeout Submittals upon Substantial Completion and at least 7 days prior to submitting Application for Final Payment:
1. Evidence of Compliance with Requirements of Governing Authorities.
 2. Project Record Documents.
 3. Operation and Maintenance Manuals.
 4. Warranties and Bonds.
 5. Keys and Keying Schedule.
 6. Evidence of Payment as outlined in Conditions of the Contract.
 7. Release of claims as outlined in Conditions of the Contract.
 8. Survey Record Documents.
 9. Certificate of Final Completion.

1.07 EVIDENCE OF COMPLIANCE WITH REQUIREMENTS OF GOVERNING AUTHORITIES

- A. Submit the following:
1. Certificate of Occupancy.
 2. Certificates of Inspection:
 - a. Mechanical.
 - b. Plumbing.
 - c. Electrical.
 - d. Overall Buildings.
 3. Permits.

1.08 PROJECT RECORD DOCUMENTS

- A. Maintain at Project site, available to City and Engineer, 1 copy of the Contract Documents, shop drawings, and other submittals in good order:
1. Mark and record field changes and detailed information contained in submittals and change orders.
 2. Record actual depths, horizontal and vertical location of underground pipes, duct banks, and other buried utilities. Reference dimensions to permanent surface features.
 3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
 4. Identify location of spare conduits including beginning, ending, and routing through pull boxes and manholes. Record spare conductors, including number and size, within spare conduits and filled conduits.
 5. Provide schedules, lists, layout drawings, and wiring diagrams.
 6. Make annotations with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

- B. Maintain documents separate from those used for construction:
 - 1. Label documents "RECORD DOCUMENTS."
- C. Keep documents current:
 - 1. Record required information at the time the material and equipment is installed and before permanently concealing.
- D. Deliver record documents with transmittal letter containing date, Project title, Contractor's name, and address, list of documents, and signature of Contractor.
- E. Record documents will be reviewed by City monthly to determine the percent complete for the monthly pay application.
- F. During progress meetings, record documents will be reviewed to ascertain that changes have been recorded.
- G. Final Schedule Submittal as specified in Section 01324B.

1.09 WARRANTIES AND BONDS

- A. Provide executed Warranty or Guaranty Form if required by Contract Documents. See General Conditions.
- B. Provide specified additional warranties, guarantees, and bonds from manufacturers and suppliers.

1.10 CERTIFICATE OF FINAL COMPLETION

- A. When 7-day operational test has been successfully completed, City will certify that new facilities are operationally complete. City will submit a list of known items (punch list) still to be completed or corrected prior to contract completion.
- B. List of items to be completed or corrected will be amended as items are resolved by Contractor.
- C. When all items have been completed or corrected, submit written certification that the entire work is complete in accordance with the Contract Documents and request final inspection.
- D. Upon completion of final inspection, City will either prepare a written acceptance of the entire work or advise Contractor of work not complete. If necessary, inspection procedures will be repeated.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01782

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Preparation and submittal of Operation and Maintenance Manuals.
- B. Related section:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.

1.02 SUBMITTALS

- A. Submit Operation and Maintenance Manuals before field quality control testing and before training of each piece of equipment or system.
- B. Draft Operation and Maintenance Manuals:
 - 1. Submit prior to shipment of equipment or system to site.
 - 2. Shipment will be considered incomplete without the draft Operation and Maintenance Manuals.
 - 3. Quantity:
 - a. Hard copy: 2 sets.
 - b. Electronic: 2 FlashDrives.
- C. Final Operation and Maintenance Manuals:
 - 1. Make additions and revisions in accordance with City's and Engineer's review comments on draft manuals.
 - 2. Submit approved Operation and Maintenance Manuals at least 30 days prior to Functional Testing and at least 60 days prior to City Training.
 - 3. Quantity:
 - a. Hard copy: 2 sets.
 - b. Electronic: 2 FlashDrives.
- D. Make manuals available at project site for use by construction personnel and City and Engineer.
- E. Make additions and revisions to the manuals in accordance with Engineer's review comments.

1.03 OPERATION AND MAINTENANCE MANUALS

- A. Preparation:
1. Provide hardcopy Operations and Maintenance Manuals in 3-ring binders with rigid covers. Utilize numbered tab sheets to organize information.
 2. Provide electronic copy Operations and Maintenance Manuals in the latest Microsoft WORD and searchable PDF Format.
 3. Provide original and clear text on reproducible non-colored paper.
 4. Provide all dimensions in English units.
 5. Engineer will work with the Contractor, equipment supplier and Plant Superintendent to prepare customized Operations and Maintenance Manuals for the various portions of the work. Contractor shall submit to Engineer all requirements described below as applicable in the format as described above for all equipment and processes.
- B. Contents of Operation and Maintenance Manuals:
1. Cover page:
 - a. Equipment name, equipment tag number, project name, City's name, appropriate date.
 2. Table of Contents:
 - a. General description of information provided within each tab section.
 3. Equipment Summary Form:
 - a. Completed form in the format shown in Attachment No. 1.
 - b. The manufacturer's standard form will not be acceptable.
 4. Lubrication information:
 - a. Required lubricants and lubrication schedules.
 5. Control diagrams:
 - a. Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.
 - b. Complete set of 11-inch by 17-inch drawings of the control system.
 - c. Complete set of control schematics.
 6. Programming:
 - a. Copies of all Contractor furnished programming.
 7. Start-up procedures:
 - a. Recommendations for installation, adjustment, calibration, and troubleshooting.
 8. Operating procedures:
 - a. Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation.
 - b. Include safety precautions and emergency operating shutdown instructions.
 9. Preventative maintenance procedures:
 - a. Recommended steps and schedules for maintaining equipment.
 10. Overhaul instructions:
 - a. Directions for disassembly, inspection, repair and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.

11. Parts list:
 - a. Complete parts list for all equipment being provided.
 - b. Availability and service locations.
 - c. Catalog data for all products or equipment furnished including generic title and identification number of each component part of equipment.
 - 1) Include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
12. Spare parts list:
 - a. Recommended number of parts to be stored at the site and special storage precautions.
13. Drawings:
 - a. Exploded view or plan and section views with detailed callouts.
 - b. Complete set of 11-inch by 17-inch drawings of equipment.
 - c. Provide electrical and instrumentation schematic record drawings.
14. Source (factory) quality control test results:
 - a. Provide copies of factory test reports as specified in the equipment section.
15. Field quality control test results:
 - a. After field-testing is completed, insert field test reports as specified in the equipment section.
16. Completed Asset form.
 - a. Contractor shall complete and submit to the City of Daytona Beach project representative the below New Asset Form on a "CD" in Microsoft® Excel format for all equipment and products furnished and installed under this Contract. A complete New Asset Form shall also be included in the Operating and Maintenance Manuals for each equipment and product submitted for the project.

C. General requirements:

1. Provide dimensions in English units.
2. Assemble material, where possible, in the same order within each volume.
3. Reduce drawings and diagrams to 8 1/2 by 11-inch size, if possible unless otherwise specified.
4. Complete forms on computer, handwriting not acceptable.
5. Delete items or options not provided in the supplied equipment or system.
6. Provide package control system annotated ladder logic for PLC, if applicable.

D. Hard copy requirements:

1. Binders: 3-ring with rigid covers.
 - a. Break into separate binders as needed to accommodate large size.
2. Utilize numbered tab sheets to organize information.
3. Provide original and clear text on reproducible non-colored paper, 8 1/2 by 11-inch size, 24 pound paper.
4. Drawings larger than 8 1/2 by 11 inch:
 - a. Fold drawings separately and place in envelope bound into the manual.
 - b. Label each drawing envelope on the outside regarding contents.

E. Electronic requirements:

1. File format:
 - a. Entire manual in PDF format.
 - 1) Include text and drawing information.

- 2) Provide a single PDF file even if the hard copy version is broken into separate binders due to being large.
 - 3) Create PDF from the native format of the document (Microsoft Word, graphics programs, drawing programs, etc.)
 - a) If material is not available in native format and only available in paper format, remove smudges, fingerprints, and other extraneous marks before scanning to PDF format.
 - b) Hard copy record drawing requirements:
 - (1) Provide a single multipage PDF file of each set of the scanned drawings.
 - (2) Page 1 shall be the cover of the drawing set.
 - c) At file opening, display the entire cover.
 - (1) Scan drawings at 200 to 300 dots per inch (DPI), black and white, Group IV Compression, unless otherwise specified.
 - (2) Scan drawings with photos in the background at 400 dots per inch (DPI), black and white, Group IV Compression.
 - 4) Pagination and appearance to match hard copy.
 - 5) Searchable.
 - 6) Scanned images are not acceptable.
 - 7) Bookmarks:
 - a) Bookmarks shall match the table of contents.
 - b) Bookmark each section (tab) and heading.
 - c) Drawings: Bookmark at a minimum, each discipline, area designation, or appropriate division.
 - d) At file opening, display all levels of bookmarks as expanded.
 - 8) Thumbnails optimized for fast web viewing.
 - b. Drawing requirements.
 - 1) Provide additional copy of drawings in most current version of AutoCAD and PDF format.
 - 2) Drawings shall have a white background.
 - 3) Drawing shapes shall not degrade when closely zoomed.
 - 4) Screening effects intended to de-emphasize detail in a drawing must be preserved.
 - 5) Delete items or options not provided in the supplied equipment or system.
2. Media:
 - a. DVD-ROM compatible with Microsoft Windows.
 - b. Flash drive.
 - c. LiquidFiles.
 3. Label media with the following information:
 - a. Operation and Maintenance Manual.
 - b. Equipment name.
 - c. Specification Section Number
 - d. Equipment tag number.
 - e. City's name.
 - f. Project number and name.
 - g. Date.
 4. If multiple submittals are made together, each submittal must have its own subdirectory that is named and numbered based on the submittal number.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

Attachment No. 1
EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT IDENTIFICATION NUMBER(S) _____
(maps equipment number)

4. LOCATION OF EQUIPMENT _____

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

NAMEPLATE DATA -

Horsepower _____

Amperage _____

Voltage _____

Service Factor (S.F.) _____

Speed _____

ENC Type _____

Capacity _____

Other _____

7. MANUFACTURER'S LOCAL REPRESENTATIVE

Name _____

Address _____

Telephone Number _____

8. MAINTENANCE REQUIREMENTS _____

9. LUBRICANT LIST _____

10. SPARE PARTS (recommendations) _____

11. COMMENTS _____

**WESTSIDE REGIONAL WATER RECLAMATION FACILITY BIOSOLIDS DEWATERING IMPROVEMENTS PROJECT
NEW ASSET FORM**

Location	Classification (type of asset)	Name (be descriptive)	Tag Number	Model	Serial Number	Vendor	Manufacturer	Warranty end date	Purchase Date	Purchase Cost	Installed Date

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SECTION 02050

SOILS AND AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Aggregate base course.
 - 2. Class 2 permeable.
 - 3. Drain rock.
 - 4. Gravel.
 - 5. Lightweight material.
 - 6. Native material.
 - 7. Sand.
 - 8. Select material.
 - 9. Stabilization material.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C 117 - Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. C 535 - Standard Test Method for Resistance to Degradation of Larger-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 5. D 422 - Standard Test Method for Particle-Size Analysis of Soils.
 - 6. D 2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 7. D 2844 - Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils.
 - 8. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - 9. D 4829 - Standard Test Method for Expansion Index of Soils.
 - 10. D 5821 - Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.03 SUBMITTALS

- A. Product data:
 - 1. Material source.
 - 2. Gradation.
 - 3. Testing data.

- B. Quality control for aggregate base course:
 1. Test reports: Reports for tests required by Sections of State of Florida Department of Transportation Standard Specifications for Road And Bridge Construction, Latest Edition.
 2. Certificates of Compliance: Certificates as required by Sections of State of Florida Department of Transportation Standard Specifications for Road And Bridge Construction, Latest Edition.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General:
 1. Provide material having maximum particle size not exceeding 4 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other organic matter.
 2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
 3. See Sections of State of Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition.
- B. Aggregate base course:
 1. Provide Aggregate Base as specified in Section 204 of the State of Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition.
- C. Class 2 permeable:
 1. Consists of hard, durable particles of stone or gravel; screened or crushed to the specified size and gradation; and free from organic matter, lumps or balls of clay, and other deleterious matter.
 2. Sand equivalent: Not less than 75 when tested in accordance with ASTM D 2419.
 3. Conforms to size and grade within the following limits when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90 - 100
3/8 inch	40 - 100
Number 4	25 - 40
Number 8	18 - 33
Number 30	5 - 15
Number 50	0 - 7
Number 200	0 - 3

D. Drain rock:

1. Consists of hard, durable particles of stone or gravel; screened or crushed to specified size and gradation; and free from organic matter, lumps or balls of clay, or other deleterious matter.
2. Crush or waste coarse material and waste fine material as required to meet gradation requirements.
3. Conforms to size and grade within the following limits when tested in accordance with ASTM C 117 and C 136:

Sieve Size (Square Openings)	Percent By Weight Passing Sieve
2 inch	100
1-1/2 inch	95 - 100
3/4 inch	50 - 100
3/8 inch	15 - 55
Number 200	0 - 2

E. Native material:

1. Sound, earthen material passing 1-inch sieve.
2. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM D 422.
3. Expansion index less than 35 when tested in accordance with ASTM D 4829.

F. Sand:

1. Clean, coarse, natural sand.
2. Non-plastic when tested in accordance with ASTM D 4318.
3. 100 percent shall pass a 1/2-inch screen.
4. No more than 20 percent shall pass a Number 200 sieve.

G. Select material:

1. Sound earthen material for which the sum of plasticity index when tested in accordance with ASTM D 4318 and the percent of material by weight passing a Number 200 sieve shall not exceed 23 when tested in accordance with ASTM D 422.
2. Organic content shall not be greater than 3 percent by volume.

H. Stabilization material:

1. Consists of clean, hard, durable particles of crushed rock or gravel; screened or crushed to the specified sizes and gradations; and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.
2. Shall be free of slaking or decomposition under the action of alternate wetting and drying.
3. The portion of material retained on the 3/8-inch sieve shall contain at least 50 percent of particles having 3 or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes the 3/8-inch sieve but is retained on the Number 4 sieve, not more than 10 percent shall be pieces that show no faces resulting from crushing.
4. Conforms to size and grade when tested in accordance with ASTM C 117 and ASTM C 136.

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90 - 100
Number 4	0 - 10
Number 200	0 - 2

PART 3 EXECUTION

3.01 See applicable sections of Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

END OF SECTION

SECTION 02200

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Clearing, grubbing and stripping project site.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.

1.02 DEFINITIONS

- A. Clearing: Consists of removal of natural obstructions and existing foundations, buildings, fences, lumber, walls, stumps, brush, weeds, rubbish, trees, boulders, utility lines, and any other items which interfere with construction operations or are designated for removal. CONTRACTOR to verify if such existing foundations, utilities or other obstructable material is present in the designated construction area of the proposed deep-bed sand filter and associated influent pump station.
- B. Grubbing: Consists of the removal and disposal of wood or root matter below the ground surface remaining after clearing and includes stumps, trunks, roots, or root systems greater than 1 inch in diameter or thickness to a depth of 6 inches below the ground surface.
- C. Stripping: Includes the removal and disposal of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped. The depth of stripping is estimated to be 6 inches, but the required depth of stripping will be determined by the Engineer.

1.03 QUALITY ASSURANCE

- A. Regulatory requirements: Verify and comply with applicable regulations regarding those governing noise, dust, nuisance, drainage and runoff, fire protection, and disposal.
- B. Pre-construction conference: Meet with Engineer to discuss order and method of work.

1.04 SEQUENCING AND SCHEDULING

- A. Clearing and grubbing: Perform clearing and grubbing in advance of grading operations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine site and verify existing conditions for beginning work.

3.02 PREPARATION

- A. Protect existing improvements from damage by site preparation work.

3.03 INSTALLATION

- A. Clearing:
 - 1. Clear areas where construction is to be performed and other areas as indicated on the Drawings, or specified in this Section, of stumps, brush, roots, weeds, trees, shrubs, rubbish, and other objectionable material of any kind which, if left in place, would interfere with proper performance or completion of the work, would impair its subsequent use, or form obstructions.
 - 2. Do not incorporate organic material from clearing and grubbing operations in fills and backfills.
- B. Grubbing:
 - 1. From excavated areas: Grub stumps, roots, and other obstructions 3 inches or over in diameter to depth of not less than 18 inches below finish grade.
 - 2. Backfill and compact cavities left below subgrade elevation by removal of stumps or roots to density of adjacent undisturbed soil.
- C. Stripping:
 - 1. Remove soil material containing sod, grass, or other vegetation to depth of 6 inches from areas to receive fill or pavement and from area within 5 feet outside foundation walls.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Loosening, excavating, filling, grading, borrow, hauling, preparing subgrade, compacting in final location, wetting and drying, and operations pertaining to site grading for buildings, basins, reservoirs, boxes, roads, and other facilities.
 - 2. Backfilling and compacting under and around structures.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedure.
 - b. Section 02742 - Asphaltic Concrete Paving.
 - c. Section 03300 - Cast-in-Place Concrete.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 2. D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)).
 - 3. D 6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.03 DEFINITIONS

- A. Backfill adjacent to structure: Backfill within volume bounded by the exterior surfaces of structure, the surface of undisturbed soil in the excavation around structure, and finish grade around structure.
- B. Embankments: Dikes, levees, berms, and similar facilities.
- C. Excavation: Consists of loosening, removing, loading, transporting, depositing, and compacting in final location, wet and dry materials, necessary to be removed for purposes of construction of structures, ditches, grading, roads, and such other purposes as are indicated on the Drawings.

1.04 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Where mud or other soft or unstable material is encountered, remove such material and refill space with stabilization material. Wrap stabilization material with stabilization fabric.
 - 2. Obtain acceptable import material from other sources if surplus or borrow materials obtained within Project site do not conform to specified requirements or are not sufficient in quantity.
 - 3. No extra compensation will be made for hauling of fill materials nor for water required for compaction.
 - 4. The City will pay for any testing services necessary (unless there is a failure and retest is required).

1.05 SUBMITTALS

- A. Copy of Property Owner's Agreement allowing placement of surplus soil material on their property.
- B. Excavation plan.
- C. Test reports:
 - 1. Submit certified test reports of all tests specified to be performed by the Contractor.
 - 2. Sign and seal test reports by a registered Geotechnical Engineer registered in State of Florida.

1.06 QUALITY ASSURANCE

- A. Initial compaction demonstration:
 - 1. Adequacy of compaction equipment and procedures: Demonstrate adequacy of compaction equipment and procedures before exceeding any of following amounts of earthwork quantities:
 - a. 50 cubic yards of backfill adjacent to structures.
 - b. 200 Linear feet of trench backfill.
 - c. 100 cubic yards of fill.
 - d. 50 cubic yards of roadway base material.
 - e. 100 cubic yards of road fill.
 - 2. Compaction sequence requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
 - 3. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as specified under "FIELD QUALITY CONTROL."

1.07 SEQUENCING AND SCHEDULING

- A. Schedule earthwork operations to meet requirements specified in this Section for excavation and uses of excavated material.
- B. If necessary, stockpile excavated material in order to use it at specified locations.

- C. Excavation, backfilling, and filling: Perform excavation, backfilling, and filling during construction in manner and sequence that provides drainage at all times.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Water for compacting: Use water from source acceptable to Engineer.
- B. Fill Materials:
 - 1. General:
 - a. Provide sand, aggregate base course, drain rock, select material, and native material, where required for fill and backfill.
 - b. Obtain material for fills from cut sections or from borrow source.
 - c. Prove material having maximum particle size not exceeding 3 inches and that is free from trash, lumber, debris, leaves, grass, roots, stumps, and other vegetable matter.
 - d. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

2. Aggregate Base Course: As specified in Section 02722.

3. Drain Rock:

- a. Consist of hard durable particles of stone or gravel, screened or crushed to specified size and gradation.
- b. Free from vegetable matter, lumps, or balls of clay, or other deleterious matter.
- c. Crushed or waste coarse material and waste fine material as required to meeting gradation requirements.
- d. Durability Index: Not greater than 40 percent when tested in accordance with ASTM C 131.
- e. Conform to size and grade within limits as follows when tested in accordance with AASHTO T-27 or ASTM C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
2 inch	100
1 - 1/2 inch	95 - 100
3/4 inch	50 - 100
3/8 inch	15 - 55

4. Native Material:

- a. Sound, earthen material passing 1 inch sieve.
- b. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM C 136.
- c. Expansion index less than 35.

5. Sand:

- a. Clear, coarse, natural sand.
- b. Non-plastic when tested in accordance with ASTM D 4318.
- c. No more than 12 percent shall pass a Number 200 screen.

6. Select Material: Sound earthen material for which sum of plasticity index when tested in accordance with ASTM D 4318 and the percent of material by weight passing number 200 sieve shall not exceed 23 when tested in accordance with ASTM C 136. Organic content shall not be greater than 3 percent by volume.

- C. Geotextile:
 - 1. Geo-textile shall have the minimum value when tested in accordance with the ASTM method listed below.
 - 2. Geotextile shall be Mirafi 500X or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions:
 - 1. Character and quantity of material:
 - a. Verify character and quantity of rock, gravel, sand, silt, water, and other inorganic or organic materials to be encountered in work to be performed.
 - b. Determine gradation and shrinkage, and swelling of soil, and suitability of material for use intended in work to be performed.
 - c. Determine quantity of material, and cost thereof, required for construction of backfills, cuts, embankments, excavations, fills, and roadway fills, whether from onsite excavations, or borrow areas or imported materials. Include in cost of work to be performed.
 - d. Include wasting of excess material, if required, in cost of work to be performed.

3.02 PREPARATION

- A. Backfills:
 - 1. After clearing and excavation are completed, scarify entire areas which underlie backfills or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
 - 2. Recompact scarified areas to density specified before placing backfill material or concrete.
 - 3. If foundation areas have soft soils, do not scarify the top 6 inches prior to compaction. Remove all loose material using hand equipment or with a flat edged backhoe bucket. Do not remold and weaken the remaining soil by operating heavy equipment on final bottom elevation of excavation.
 - 4. Do not place backfill against walls until:
 - a. Walls have been cast full height of structure and concrete has reached the specified strength.
Connecting slabs and beams have been cast and concrete has reached the specified strength.
 - 5. Prior to backfilling:
 - a. Remove all forms.
 - b. Clean all trash and debris from the excavation site.
 - 6. After inspection of foundation, walls, and pipes, place backfill symmetrically around structures to prevent eccentric loading of structures.
- B. Fills:
 - 1. After clearing is completed, scarify entire areas which underlie fill sections or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.

2. Recompact scarified areas to density specified for compacted fills before placing of fill material or concrete.
- C. Roadway fills:
1. After clearing is completed, scarify entire areas which underlie roadway fills to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
 2. Recompact scarified areas to density specified for roadway fills before placing of roadway fill material.

3.03 INSTALLATION

- A. General:
1. Dispose of excavated materials which are not required or are unsuitable for fill and backfill in lawful manner at no additional cost to the Owner. Unsuitable materials shall be hauled off-site.
 2. Rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension: Remove from project site at no additional cost to the Owner.
 3. Stabilization of subgrade: Provide materials used, or perform work required, to stabilize subgrade so it can withstand loads that may be placed upon it by Contractor's equipment.
- B. Compaction:
1. Provide specified compaction for backfills, cuts, embankments, fills, roadway fills, and other earthwork.
 2. Perform confirmation tests to verify and confirm that work has complied, and is complying at all times, with compaction requirements specified in this Section for initial compaction demonstration and field quality control testing.
 3. In-place density of compacted backfills, cuts, embankments, fills, and roadway fills determined in accordance with ASTM D 1556, or with ASTM D 6938.
 4. Maximum density obtained in laboratory when tested in accordance with ASTM D 1557.
 5. To prevent damage to structures due to backfilling operations, place backfill with equipment that does not exceed H-20 loading, within a distance from the face of the structure of not less than 1/2 the depth of backfill. The depth of backfill is the distance between the level being compacted and the bottom of the excavation. Outside this distance, heavier compaction equipment may be used.
 6. Compact to percentage of maximum density as follows:
 - a. Backfill adjacent to structures: 95 percent.
 - b. Backfilling voids: 95 percent.
 - c. Bottom of sludge beds: 90 percent.
 - d. Embankments: 95 percent.
 - e. Demolition areas: As indicated on the Drawings.
 - f. Intermediate dikes: 90 percent.
 - g. Loose fill:
 - 1) No compaction other than by hauling vehicles will be required.
 - 2) Uniformly distribute travel of vehicles over fill area as required to provide uniformly compacted surface.
 - h. Other areas: 85 percent.
 - i. Spoil areas indicated on the Drawings: No minimum required.

- j. Under present and future structures: 95 percent.
 - k. Under roadways, parking and storage areas, curbs, and sidewalks: 95 percent.
 - l. Upper 6 inches of cuts: 95 percent.
 - m. Fills: 95 percent.
- C. Materials for backfills, embankments, fills, and roadway fills:
- 1. General:
 - a. Obtain import material from other sources if surplus materials from cuts and excavations obtained from within Project site do not conform to specified requirements or are not sufficient in quantity for construction of Project.
 - 2. Backfills:
 - a. Backfill adjacent to structures, slabs, or walls: Native material or imported material meeting the requirements of native material, unless otherwise specified or indicated on the Drawings.
 - b. Backfill material under concrete structures: Aggregate base course material, except in areas where controlled low-strength material or concrete encasement are indicated on the Drawings.
 - c. Extend backfill in any area under concrete structures from undisturbed soil or rock to the bottom aggregate base course material layer.
 - 3. Embankments:
 - a. Native material or imported material meeting the requirements of native material, unless otherwise specified or indicated on the Drawings.
 - 4. Fills:
 - a. Native material or imported material meeting the requirements of native material, unless otherwise specified or indicated on the Drawings.
 - b. Extend fill in any area under concrete structures from undisturbed soil or rock to the bottom aggregate base course material layer.
 - 5. Roadway fills: One of the following, unless otherwise specified or indicated on the Drawings:
 - a. Aggregate base course material.
 - b. Native material or imported material meeting the requirements of native material.
- D. Placement:
- 1. General:
 - a. Lines and grades:
 - 1) Construct backfills, embankments, fills, and road fills, at locations and to lines and grades indicated on the Drawings.
 - 2) Overbuild all permanent fill slopes by at least 1 foot and then cut to final grade to provide adequate compaction of the remaining fill.
 - 2. Backfills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted backfills: Remove and recompact.

3. Fills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted fills: Remove and recompact.
4. Lightweight materials:
 - a. When excavations extend into soft soils, backfill consists of lightweight material from base of excavation to the top of the soft soil. Above soft soil, native material may be used.
 - b. Where lightweight material is used for backfill: Separated from adjacent soils by the use of filter fabric.
5. Embankments:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted embankments: Remove and recompact.
6. Roadway fills:
 - a. Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - b. Bring each layer to a moisture content between optimum moisture content and 3 percent above optimum moisture content before compacting.
 - c. Defective compacted roadway fills: Remove and recompact.
7. Loose fill:
 - a. In disposal areas: In disposal areas as indicated on the Drawings, bring fill up in an essentially level layer over entire spoil area indicated:
 - 1) Continue filling spoil area until disposal of surplus excavated material is completed.
 - 2) Slope edges of fill area at between 1 and 2 horizontal to 1 vertical to the intersection with existing grade.
 - 3) Provide slopes that are smooth and uniform.
 - 4) Level finished surface of disposal area to within 4 inches of elevation indicated on the Drawings.

3.04 FIELD QUALITY CONTROL

- A. Tests:
 1. Confirmation tests:
 - a. Contractor's responsibilities:
 - 1) Accomplish specified compaction for backfills, fills, and other earthwork.
 - 2) Control operations by confirmation tests to verify that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
 - 3) Cost of confirmation tests: Paid for by the Contractor.
 - 4) Qualifications of Contractor's testing laboratory: Perform confirmation testing by soils testing laboratory acceptable to the Engineer.
 - 5) Copies of confirmation test reports: Submit promptly to the Engineer.

2. Compliance tests:
 - a. Periodic compliance tests will be made by the Engineer to verify that compaction is meeting requirements previously specified.
 - b. Remove overburden above level at which the Engineer wishes to test. Backfill and recompact excavation after testing is completed.
 - c. If compaction fails to meet specified requirements, perform remedial work by one of the following methods:
 - 1) Remove and replace materials at proper density.
 - 2) Bring density up to specified level by other means acceptable to the Engineer.
 - d. Retesting:
 - 1) Contractor bears the costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements.
 - 2) Contractor's confirmation tests during performance of remedial work: Double the normal rate specified.

B. Tolerances:

1. Finish grading of backfills, cuts, embankments, fills, and roadway fills:
 - a. Perform fine grading under concrete structures such that finish surfaces are never above the grade or cross section indicated on the Drawings and are never more than 0.10 feet below.
 - b. Provide finish surface for areas outside of structures that are within 0.10 feet of grade or cross section indicated on the Drawings.
2. Unlined channels and basins:
 - a. In both cut and fill, and levee and access road side slopes in cut: Vertical tolerance of none above and 3 inches below grade indicated on the Drawings on bottom and side slopes.
 - b. On top surface of levee and access road in both cut and fill, and levee and access road side slopes in fill: Vertical tolerance of none below and 3 inches above grade indicated on the Drawings.
3. Areas which are not under structures, concrete, asphalt, roads, pavements, sidewalks, dikes, and similar facilities:
 - a. Provide finish graded surfaces of either undisturbed soil, or cohesive material not less than 6 inches deep.
 - b. Intent of proceeding is to avoid sandy or gravelly areas.
4. Finish grading of surfaces:
 - a. Reasonably smooth, compacted, and free from irregular surface changes.
 - b. Provide degree of finish that is ordinarily obtainable from blade grader operations, except as otherwise specified.
 - c. Uniformly grade areas that are not under concrete.
 - d. Finish ditches and gutters so that they drain readily.

3.05 ADJUSTING

- A. Finish grades of excavations, backfills, and fills:
1. Repair and reestablish grades to required elevations and slopes due to any settlement or erosion that may occur from action of the elements or any other cause prior to final acceptance.

3.06 PROTECTION

- A. Finish grades of backfills, cuts, excavations, and fills:
 - 1. Protect newly graded areas from erosion and deterioration by action of the elements.

- B. Ditches and gutters:
 - 1. Maintain ditches and gutters free from detrimental quantities of debris that might inhibit drainage until final acceptance.

END OF SECTION

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SECTION 02318

TRENCHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Trench excavation, fine grading, pipe bedding, backfilling, and compaction for the following, including requirements for ditch crossings:
 - 1. Pipes.
 - 2. Direct buried electrical and control conduits.
 - 3. Electrical and control duct banks.
 - 4. Manholes, valves, or other accessories.
 - 5. Potable water pipe appurtenances.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02050 - Soils and Aggregates for Earthwork.
 - b. Section 02300 - Earthwork.
 - c. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 2. D 1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m^{3 - 3. D 6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).}

1.03 SUBMITTALS

- A. Lab certification.

- B. Confirmation test reports.

1.04 QUALITY ASSURANCE

- A. Initial compaction demonstration:
 - 1. Adequacy of compaction equipment and procedures: Demonstrate adequacy of compaction equipment and procedures before exceeding any of following amounts of earthwork quantities:
 - a. 200 linear feet of trench backfill.
 - 2. Compaction sequence requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
 - 3. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as specified under "FIELD QUALITY CONTROL."

PART 2 PRODUCTS

2.01 MATERIALS

- A. Soil and rock materials:
 - 1. Aggregate base course material: As specified in Section 02050.
 - 2. Gravel: As specified in Section 02050.
 - 3. Native material: As specified in Section 02050.
 - 4. Sand: As specified in Section 02050.
 - 5. Select material: As specified in Section 02050.

PART 3 EXECUTION

3.01 PREPARATION

- A. General:
 - 1. Embankment condition:
 - a. Exists where width of trench exceeds limits specified in this Section.
 - b. Before laying pipes in fill, place fill and compact it to not less than 2 feet above top of pipe.
 - c. After placing and compacting fill, excavate pipe trench through fill.
- B. Protection: Stabilize trench excavations.

3.02 INSTALLATION

- A. Trench excavation:
 - 1. General requirements:
 - a. If, because of soil conditions, safety requirements, or other reasons, trench width at top of pipe is increased beyond width specified in this Section, upgrade laying conditions or install stronger pipe designed in conformance with Specifications for increased trench width, without additional cost to Owner.
 - b. Excavate bottom of trench to depth indicated on the Drawings. The bottom of the trench excavation shall be firm and dry.

2. The trench may be excavated by machinery to the grade indicated on the Drawings provided that the soil material remaining in the bottom of the trench is no more than slightly disturbed.
3. Rock:
 - a. Pipe: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of fine grading material. Backfill overcut with aggregate base course material compacted to 95 percent of maximum density up to bottom of fine grading material.
 - b. Direct buried electrical and control conduits: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of conduit bedding material. Backfill overcut with aggregate base course material up to bottom of conduit bedding material.
 - c. Electrical and control ductbanks: If bottom of trench excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of concrete ductbank. Backfill overcut with aggregate base course material up to bottom of concrete ductbank.
4. Overcut of trench bottom: Where the bottom of the trench is excavated below the depth indicated on the Drawings, restore trench bottom to proper grade by back filling with aggregate base course material compacted to 95 percent of maximum density, at no additional cost to Owner.
5. Soft or unstable material:
 - a. If bottom of excavation is found to consist of soft or unstable material which is incapable of providing proper support, remove such material to a depth and for the length required, as determined by the Engineer. Backfill trench to bottom of fine grading material with aggregate base course material compacted to 95 percent of maximum density.
6. Concrete cradle: Where indicated on the Drawings, cradle pipe in concrete.
7. Trench widths:
 - a. Minimum clear width of trench for pipe (measured at top of pipe):
 - 1) For pipe sizes 4 inches to and including 24 inches: Not less than outside diameter of pipe plus 18 inches.
 - 2) For pipe sizes larger than 24 inches: Not less than outside diameter of pipe plus 24 inches.
 - b. Maximum clear width of trench for pipe (measured at top of pipe):
 - 1) For pipe sizes 4 inches to and including 24 inches: Not to exceed outside diameter of pipe plus 24 inches.
 - 2) For pipe sizes larger than 24 inches: Not to exceed outside diameter of pipe plus 36 inches.
8. For manholes, valves, or other accessories:
 - a. Provide excavations sufficient to leave at least 12 inches clear between their outer surfaces and sides of trench or shoring.
 - b. Backfilling of manhole excavation: Conform to backfilling requirements as specified for trenches in this Section.
 - c. Backfill under manholes, vaults, tanks, or valves with aggregate base course material. Do not backfill with soil.

- d. Fill any unauthorized excess excavation below elevation indicated on the Drawings for foundation of any structure with aggregate base course material at no additional cost to Owner.
- 9. Potable water pipe appurtenances:
 - a. Lay in trenches separate from those used for sewers.
 - b. Unless otherwise specified or indicated on the Drawings, lay in trenches having cover of not less than 3 feet below surface of ground and located at distance of not less than 10 feet from any parallel sewer trench.
- 10. At road crossings or existing driveways:
 - a. Make provision for trench crossings at these points, either by means of backfills, tunnels, or temporary bridges.
- B. Pipe fine grading:
 - 1. Schedule fine grading material as specified in this Section.
 - 2. For pipes 16 inches in nominal diameter and under.
 - a. Place 4 inches of fine grading material below bottom of pipe.
 - b. Place fine grading material at uniform density, with minimum possible compaction.
 - 3. For pipe over 16 inches in diameter.
 - a. Place 4 inches, or 1/12 the outside diameter of pipe, whichever is greater, of fine grading material below bottom of pipe.
 - b. Place fine grading material at uniform density, with minimum possible compaction.
 - 4. Bell or coupling holes:
 - a. Dig holes after trench bottom has been graded.
 - b. Provide holes of sufficient width to provide ample room for grouting, banding, or welding.
 - c. Excavate holes only as necessary for making joints and to ensure that pipe rests upon prepared trench bottom and not supported by any portion of the joint.
 - 5. Depressions for joints, other than bell-and-spigot:
 - a. Make in accordance with recommendations of joint manufacturer for particular joint used.
- C. Pipe bedding:
 - 1. Schedule bedding material as specified in this Section.
 - 2. After pipe laid:
 - a. Place bedding material under and around pipe in 6 inch maximum lifts of bedding material, to level 12 inches above top of pipe. Compact to 95 percent of maximum density.
 - 3. Pipe displacement:
 - a. Take necessary precautions in placement and compaction of bedding material to prevent displacement of piping.
 - b. In event there is movement or floating of the piping, re-excavate, re-lay, and backfill the pipe.
- D. Trench backfill above pipe bedding, electrical and control conduit bedding, and electrical and control ductbanks:
 - 1. Under structures:
 - a. Backfill trench up to underside of structure with aggregate base course material as specified in Section 02050 compacted to 95 percent of maximum density.

2. Cuts across roadways and paved streets:
 - a. Backfill trench to underside of pavement with aggregate base course material as specified in Section 02050 compacted to 95 percent of maximum density.
 3. Under and parallel to roadways, paved areas, or storage areas:
 - a. Backfill trench up to within 2 feet of finish grade with native material compacted to 95 percent of maximum density.
 - b. Then backfill from 2 feet below finish grade to finish grade, or underside of aggregate base course or pavement as indicated on the Drawings with aggregate base course material as specified in Section 02050, compacted to 95 percent of maximum density.
 4. In areas outside the improved section of roadways or in open country:
 - a. Backfill to finish grade with native material as specified in Section 02050 compacted to 95 percent of maximum density.
 5. Through earth slopes adjacent to, or supporting structures:
 - a. Backfill to finish grade with aggregate base course material or select material compacted to 95 percent of maximum density.
- E. Under existing intersecting pipes or conduits larger than 3 inches in diameter:
1. Backfill from bottom of new pipe trench to spring line of intersecting pipe or conduit with aggregate base course material, as specified in Section 02050, compacted to 95 percent of maximum density.
 2. Extend aggregate base course material as specified in Section 02050 two feet on either side of intersecting pipe or conduit to ensure that material remains in place while other backfill is being placed.
 3. Backfill remainder of trench as specified in "Trench backfill above pipe bedding and for conduits and duck banks" above.
- F. Compaction:
1. In-place density of compacted trench backfill, and bedding determined in accordance with ASTM D 1556, or with ASTM D 6938.
 2. Maximum density obtained in laboratory when tested in accordance with ASTM D 1557.
 3. Consolidation:
 - a. Do not use water settling methods such as flooding, poling, or jetting.
 4. Consolidation:
 - a. When acceptable to the Engineer, perform consolidation by flooding and poling, or jetting so as to obtain compaction of backfill material at least equal to that specified.
 - b. Do not use water settling methods when backfill material is not sufficiently granular in nature to be self-draining during and after consolidation and when foundation materials may be softened or otherwise damaged by water.
 - c. When flooding, poling, or jetting methods are used, place and consolidate material used as backfill in layers not exceeding 4 feet in thickness.
 - d. Supplement flooding, poling, or jetting methods by use of vibratory or other compaction equipment when necessary to obtain required compaction.
- G. Excess material:
1. Remove excess excavated material from the Project site as specified in Section 02300 and dispose of legally off site.

3.03 FIELD QUALITY CONTROL

A. Tests:

1. Confirmation tests:
 - a. CONTRACTOR's responsibilities:
 - 1) Accomplish specified compaction of trench backfill.
 - 2) Control operations by confirmation tests to verify and confirm that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
 - 3) Cost of confirmation tests: Paid for by the CONTRACTOR.
 - 4) Qualifications of CONTRACTOR's testing laboratory: Acceptable to Engineer. Provide lab certification.
 - 5) Copies of confirmation test reports: Submit promptly to the Engineer.
 - b. Frequency of confirmation testing:
 - 1) Perform testing not less than as follows:
 - a) For trenches: At each test location include tests for each type or class of backfill from bedding to finish grade.
 - b) In open fields: 2 every 1,000 linear feet.
 - c) Along dirt or gravel road or off traveled right-of-way: 2 every 500 linear feet.
 - d) Crossing paved roads: 2 locations along each crossing.
 - e) Under pavement cuts or within 2 feet of pavement edges: 1 location every 400 linear feet.
2. Compliance tests:
 - a. Frequency of testing: Periodic compliance tests will be made by the Engineer to verify that compaction is meeting requirements previously specified.
 - b. If compaction fails to meet specified requirements: Perform remedial work by one of the following methods:
 - 1) Remove and replace backfill at proper density.
 - 2) Bring density up to specified level by other means acceptable to the Engineer.
3. Retesting:
 - a. Costs of retesting: CONTRACTOR is responsible for the costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements.
 - b. CONTRACTOR's confirmation tests during performance of remedial work:
 - 1) Performance: Perform tests in manner acceptable to the Engineer.
 - 2) Frequency: Double amount specified for initial confirmation tests.

B. Piping system testing:

1. As specified in Section 15956.

3.04 SCHEDULES

A. Pipe fine grading materials:

1. Fine grading material shall be the same as bedding material.

- B. Bedding materials:
 - 1. Pipes:
 - a. For pipe less than 16-inch nominal size: Except as otherwise specified, use sand or aggregate base course material.
 - b. For pipe from 16- inch to 48-inch nominal size: Except as otherwise specified, use sand or aggregate base course material.
 - c. For pipe over 48 inches: Aggregate base course material.
 - d. For polyvinyl chloride or other plastic pipe less than 2 inches in diameter: Sand.
 - 2. Direct buried electrical and control conduits: Sand or Flowable Fill.

END OF SECTION

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SECTION 02722

AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Aggregate base course.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the CMAR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CMAR's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CMAR to see that the completed Work complies accurately with the Contract Documents.

1.02 REFERENCES

- A. Florida Department of Transportation:
 - 1. Standard Specifications for Road and Bridge Construction
- B. ASTM International (ASTM):
 - 1. C 117 - Standard Test Method for Materials Finer than 75 μ M (No. 200) Sieve in Mineral Aggregate by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- C. City of Daytona Beach Standard Specification and Details:
<http://www.codb.us/DocumentCenter/Home/View/900>.

1.03 SUBMITTALS

- A. Product data:
 - 1. Source.
 - 2. Gradation.
 - 3. Testing data.
- B. Quality control:
 - 1. Test reports: As required by Sections of Division 2.
 - 2. Certificates of Compliance: As required by Sections of Division 2.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate base course:
 - 1. Consist of hard, durable particles or fragments of stone or gravel, screened or crushed to required size and grading and free from vegetable matter, lumps, or balls of clay, alkali, adobe, or other deleterious matter.
 - 2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
 - 3. Materials derived from processing demolished or removed asphalt concrete can be blended with approved base course material and used only as base course under asphaltic concrete paving. It cannot be used as structural backfill under or around any buried facilities.
 - 4. When sampled and tested in accordance with specified test methods, material shall comply with following requirements:
 - a. Durability: Percentage of wear not greater than 40 percent when tested in accordance with ASTM C 131.
 - b. Plasticity index: Not be more than 5 when tested in accordance with ASTM D 4318.
 - c. Liquid limit: Not be more than 25 percent when tested in accordance with ASTM D 4318.
 - 5. Aggregate base course for structures:
 - a. Consist of crushed or fragmented particles.
 - 6. Conform to size and grade within limits as follows when tested in accordance with ASTM C 117 and ASTM C 136:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
1-1/2 inch	95 - 100
3/4 inch	65 - 90
Number 4	35 - 60
Number 10	25 - 45
Number 50	5 - 25
Number 200	0 - 10

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine conditions upon which the work specified in this Section depends for defects that may influence installation and performance.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Subgrade preparation: Prepare as specified in Section 02300.

3.03 INSTALLATION

- A. Furnish, spread, and compact material to the lines, grades, and dimensions indicated on the Drawings:
 - 1. Spread in accordance with sections of Division 2.
 - 2. Compact in accordance with sections of Division 2.

3.04 FIELD QUALITY CONTROL

- A. Tests: Perform field tests as required by sections of Division 2.

END OF SECTION

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SECTION 02742

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Asphalt concrete pavement on prepared subgrade or aggregate base course, and on existing pavement, to lines, grades, compacted thicknesses, and cross sections indicated on the Drawings.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard Specifications for Transportation Materials and Methods of Sampling and Testing:
 - a. MP1: Specification for Performance Graded Asphalt Binder.
- B. ASTM International (ASTM):
 - 1. C 117 - Standard Test Method for Material Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. D 977 - Standard Specification for Emulsified Asphalt.
 - 5. D 1559 Test Method for Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus.
 - 6. D 3381 - Specification for Viscosity-Graded Asphalt Cement for use in Pavement Construction.
 - 7. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- C. City of Daytona Beach Standard Specification and Details:
<http://www.codb.us/DocumentCenter/Home/View/900>.

1.03 DEFINITIONS

- A. Bituminous prime coat: Consist of application of hot bituminous material on previously prepared base course.

1.04 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Compact the asphalt concrete to at least 95 percent of the density of the laboratory specimen of the same mixture subjected to 75 blows of a standard Marshall hammer test in accordance with ASTM D1559.

1.05 SUBMITTALS

- A. Proposed mix design and gradation of materials.
- B. Quality control submittals:
 - 1. Certificate of Compliance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Asphalt concrete delivery:
 - 1. Transport the mixture from the mixing plant to the point of use in vehicles having tight bodies previously cleaned of all foreign materials.
 - 2. Treat bodies as necessary to prevent material from sticking to the bodies.
 - 3. Cover each load with canvas or other suitable material of sufficient size and thickness to protect the asphalt mixture from the weather.

1.07 PROJECT CONDITIONS

- A. Environmental requirements:
 - 1. Asphalt concrete:
 - a. Place asphalt concrete only when surface is dry, when atmospheric temperature in the shade is 40 degrees Fahrenheit and rising, or above 50 degrees Fahrenheit if falling.
 - b. Do not place asphalt concrete when weather is foggy or rainy nor when base on which material is to be placed is in wet or frozen condition.
 - 2. Prime coat:
 - a. Do not apply prime coat when atmospheric temperature is below 60 degrees Fahrenheit.
 - b. Apply prime coat only when base course is dry or contains moisture not in excess of that which will permit uniform distribution and desired penetration.

1.08 SEQUENCING AND SCHEDULING

- A. Prime coat:
 - 1. Prior to requesting Engineer's acceptance for application, inspect area to be coated to determine its fitness to receive bituminous priming material.
 - 2. Do not begin application before area to be coated has been accepted for application by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Prime coat: Asphalt prime coat shall be asphalt emulsion Type RS-2, CRS-2 or liquid asphalt RC-70 or RC-250 conforming to Section 916 of the FDOT Standard Specifications.
- B. Sand: Acceptable to the Engineer.
- C. Tack coat: Asphalt emulsion shall be RS-2, SS-1, or SS - 1H conforming to Section 916 of the FDOT Standard Specification.

D. Asphalt concrete materials:

1. Asphalt cement: Conform to requirements for asphalt cement, AR-4000, ASTM D 3381.
2. Mineral aggregate:
 - a. Consist of coarse aggregate of crushed stone or gravel composed of hard, durable particles, sand, and filler as follows:
 - 1) Coarse aggregate: Portion of material retained on Number 8 sieve.
 - 2) Fine aggregate: That portion passing Number 8 sieve.
 - b. Provide composite material that is uniformly graded from coarse to fine and that complies with requirements of one of following gradings when tested in accordance with ASTM C 136.
 - c. Asphalt concrete: 2 course plant mix for asphalt concrete having an overall thickness of 2 1/2 inches or more if not indicated. If less than 2-1/2 inches asphalt concrete, use single course plant mix.

Plant Mix, Two Course				Plant Mix, Single Course	
Seal, 3/4 inch Thick Minimum		Base, 1-3/4 inch Thick Minimum		1-1/2 inch Thick Minimum	
Sieve Size	Percent Passing	Sieve Size	Percent Passing	Sieve Size	Percent Passing
1/2"	100	1-1/4"	100	3/4"	100
3/8"	95 - 100	1"	87 - 100	1/2"	75 - 95
No. 4	50 - 70	3/4"	75 - 90	3/8"	65 - 85
No. 8	35 - 55	3/8"	55 - 72	No. 4	50 - 65
No. 30	15 - 30	No. 4	40 - 60	No. 8	35 - 50
No. 100	5 - 15	No. 8	30 - 50	No. 30	15 - 30
No. 200	3 - 8	No. 30	15 - 30	No. 100	5 - 15
		No. 100	5 - 15	No. 200	3 - 8
		No. 200	3 - 8		

3. Coarse aggregate:
 - a. Consist of at least 70 percent by weight of each size aggregate and consist of particles, which have at least 1 rough, angular surface produced by crushing:
 - 1) Have percentage of wear of not more than 50 at 500 revolutions, in accordance with ASTM C 131.
 - b. Aggregate plasticity index: Not more than 2 in accordance with ASTM D 4318.
 - c. Sand may be added to crusher or pit run product to supply any deficiency in 8-mesh size, and filler may be added to supply any deficiency in 200-mesh material. If aggregate contains an excess of sand, wasting will be required.
 - d. Filler:
 - 1) Use finely powdered limestones, portland cement, or other artificially or naturally powdered mineral dust, acceptable to the Engineer.
 - 2) Weigh filler and add separately to each batch at time of proportioning.
 - 3) Use filler that is free from deleterious matter of any kind.
 - 4) Fineness that meet the following requirements:
 - a) Passing 50 mesh sieve: 100 percent.
 - b) Passing 200 mesh sieve: At least 75 percent.

- 5) Determine amount of material passing the Number 200 sieve in accordance with ASTM C 117.
- e. Provide composite aggregate that is free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter which would prevent thorough coating of asphalt cement.
- f. Materials derived from processing demolished, or removed asphalt concrete, are not acceptable.

E. Fog sealing: Asphalt emulsion, Grade SS-1h.

2.02 EQUIPMENT

- A. Bituminous distributor: Designed and equipped so as to distribute bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rate with pressure range of 25 to 75 pounds per square inch.
- B. Liquid asphalt distributor:
 1. Designed and operated to distribute asphaltic material in uniform spray without atomization.
 2. Equipped with bitumeter having dial registering feet of travel per minute.
 - a. Locate dial so that it is visible to truck driver so that he can maintain constant speed required for application at specified rate.
 3. Equip pump with tachometer having dial registering gallons per minute passing through nozzles.
 - a. Locate dial so that it is readily visible to operator.
 4. Provide means for accurately indicating temperature of asphaltic material in distributor at all times.
 - a. Locate thermometer well so that it is not in contact with, or close to, heating tube.
 5. Have spray bar having normal width of application of not less than 12 feet and capable of providing for application of lesser width when necessary.
 6. Provided with hose and spray nozzle attachment for applying asphaltic material to patches and areas inaccessible to spray bar.
 7. Equipped with heating attachments and capable of circulating asphaltic material through spray bar during entire heating process.
- C. Asphalt concrete mixing plants:
 1. Equipment:
 - a. Use screen and storage bins at plant of sufficient capacity to furnish the necessary amount of all aggregates, when operating at the maximum capacity of the plant, with no periods of undue waiting for material.
 - 1) Use bins consisting of at least 2 compartments, so proportioned as to insure adequate storage of appropriate fractions of the aggregate.
 - 2) Provide each compartment with an overflow pipe of such size and at such location as to prevent any backing up of material into other compartments.
 - b. Dryer:
 - 1) Designed to heat and dry the aggregate to Specification requirements and to agitate it continuously during the heating.
 - 2) Capable of preparing aggregates at a rate equal to the full-rated capacity of the plant.

- c. Dust collector:
 - 1) So constructed as to waste or return uniformly to the hot elevator all or any part of the material collected.
 - d. Mixer:
 - 1) Adequate capacity, with twin shafts.
 - e. Thermometers:
 - 1) Furnished for determining the temperature of the mix.
 - f. Weighting and measuring equipment:
 - 1) Weighing or volumetric measuring equipment of sufficient capacity.
 - 2) Devices to permit easy readjustment of any working part needing readjustment, so that the equipment will function properly and accurately.
 - 3) Attach scales for weighing to the bucket.
 - 4) Test and seal all weighing equipment by a representative of the Inspector of Weights and Measures having jurisdiction, as often as the Engineer may deem necessary to insure accuracy.
 - g. Tanks for storage of bituminous material:
 - 1) Capable of heating the material under effective and positive control at all times to temperatures within the range stipulated.
2. Asphalt concrete plant operation:
- a. Mineral aggregate:
 - 1) Dry and heat mineral and then screen into at least 2 fractions and conveyed into separate compartments ready for proportioning and mixing.
 - 2) When combined with asphalt cement.
 - b. Aggregate:
 - 1) Contain not more than 2 percent moisture by weight.
 - 2) Be at a temperature within the range of that specified for the asphalt cement but not more than 25 degrees Fahrenheit above the temperature of the asphalt cement.
 - c. Combine dry aggregate in the plant in the proportionate amounts of each fraction of aggregate required to meet the specified grading.
 - 1) Introduce the asphalt cement into the mixer in the amount and at the temperature for the particular material being used.
 - 2) Continue mixing for at least 30 seconds, and for such longer period as may be necessary to coat all the particles.
 - d. When a continuous mixer is used, determine the mixing time by weight method using the following formula:
 - 1) $\text{Mixing time in seconds} = \text{Pugmill dead capacity in pounds.}$
 - 2) $\text{Pugmill output in pounds per second.}$

D. Asphalt concrete placing equipment:

- 1. Use equipment for placing, spreading, shaping, and finishing asphalt concrete consisting of a self-contained power machine operating in such manner that no supplemental spreading, shaping, or finishing is required to provide surface which complies with requirements for smoothness contained in this Section.
 - a. In areas inaccessible to the machine, hand spreading may be permitted.
- 2. Furnish 1 self-propelled, pneumatic-tired roller, and one 8 ton (minimum), smooth-wheel tandem roller.
 - a. When spreading is in excess of 100 tons per hour, furnish 1 additional roller of either type for each additional 100 tons, or fraction thereof, spread per hour.

2.03 MIXES

- A. Asphalt cement:
 - 1. Do not mix at temperatures lower than 275 degrees Fahrenheit nor higher than 325 degrees Fahrenheit.
 - 2. Usual amount of asphalt cement, by weight, to be added to aggregate be 5.4 percent to 5.8 percent of weight of mixture.

- B. Asphalt concrete:
 - 1. Before being delivered to the site, mix aggregate with asphalt cement at central mixing plant.
 - 2. Use mixing plants that are in good working order with no excessively worn parts and so equipped that:
 - a. Temperatures of aggregates leaving dryer, of asphalt cement entering mixer, and of mix leaving mixer can be readily determined and positively controlled within Specification limits at all times.
 - b. Weights of different sizes of aggregates and of asphalt cement as set by the Engineer can be consistently introduced into mixer.
 - c. Asphalt cement can be uniformly distributed throughout mixture with aggregate completely coated.
 - d. Mixing time can be positively controlled to minimum specified.
 - e. Bin samples of aggregate can be readily obtained.
 - f. Provide means of calibrating weighing devices.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protection
 - 1. Prime coated surfaces:
 - a. Maintain surfaces until succeeding layer of pavement has been placed.
 - b. During this interval, protect primed surfaces against damage and repair any broken spots.

- B. Surface preparation:
 - 1. Prime coat:
 - a. Where portions of base course prepared for immediate treatment are excessively dry, sprinkle such portions lightly with water immediately in advance of prime coat application.
 - b. Immediately following preparation of base course, apply bituminous material by means of bituminous distributor at the temperature previously specified.
 - c. Apply priming material in manner that results in uniform distribution being obtained at all points of surface to be primed.
 - d. Following the application of prime material, allow the surface to dry for a period of not less than 48 hours without being disturbed, or for such additional period of time as may be necessary to obtain penetration into the base course and drying out or evaporation of the volatiles from prime material.
 - e. Spread sufficient sand on areas which show an excess of bituminous material to effectively blot up and cure the excess.

2. Base courses:
 - a. Thoroughly clean base and apply prime coat before placing asphalt concrete.
 - b. Thoroughly clean any existing base, surfacing, or pavement prior to placing plant-mixed surfacing.
 - c. Where existing pavement is being widened or extended cut to straight vertical face and treat with asphalt paint binder prior to paving operations.
 - d. When asphalt concrete is to be applied over existing pavement and local irregularities in existing surface would result in course of more than specified thickness, bring surface of existing pavement to uniform contour by patching with asphalt concrete thoroughly tamped or rolled until it conforms with surrounding surface, and then apply tack coat.

3.02 APPLICATION

- A. At existing asphalt to be paved over: Apply tack coat at minimum rate of 0.10 gallons per square yard.
- B. Placing and compacting asphalt concrete:
 1. Placing and compacting asphalt mixture: Progress in sections generally not more than 750 linear feet in length.
 2. Spreading of mixture:
 - a. Spread, shape, and finish by specified equipment.
 - b. Spread each successive strip adjacent to previously spread strip.
 - c. Do not compact minimum 6-inch width of each strip adjacent to new strip until after new strip has been placed.
 - d. Spread as nearly continuous as possible.
 - e. Laying against vertical surfaces such as gutters: Roughen and clean face of vertical surfaces as required for proper bonding and then paint with light coating of asphalt cement or emulsified asphalt.
 - f. At terminations of new surface courses: Feather asphalt mixture into existing surface over such distance as may be required to produce smooth riding transition.
 - g. Base course and single course construction: Joined by vertical butt joints, finished and rolled to smooth surface.
 - h. Rolling:
 - 1) Perform initial or "breakdown" rolling with tandem power roller and follow spreading operation when mixture has reached temperature where it does not "pick up" on rolls.
 - 2) Keep rolls properly moistened but do not use surplus of water.
 - 3) Follow initial rolling with pneumatic roller when mixture is in proper condition and when rolling does not cause undue displacement, cracking, or shoving.
 - 4) Begin rolling at sides and progress gradually to center, lapping each preceding track until entire surface has been rolled.
 - 5) Terminate alternate trips of roller in stops at least three feet distant from any preceding stop.
 - 6) At any place not accessible to roller, thoroughly compact mixture with tampers and finish, if necessary, with hot iron to provide uniform layer over entire width being paved.
 3. Provide finish surface having uniform texture.

- C. Fog sealing:
 - 1. Fog seal asphalt pavement after compaction with fog sealing material applied at rate of 0.05 gallons per square yard at following locations:
 - a. At locations indicated on the Drawings.

- D. Full-depth asphalt pavement:
 - 1. CMAR's option:
 - a. Install either full-depth asphalt pavement or asphalt over 6 inch aggregate base course where reservoir bottoms are indicated on the Drawings.
 - b. Install either asphalt and aggregate base material or full-depth asphalt pavement in areas where paving is indicated on the Drawings or specified to be 2 inches of asphalt concrete over aggregate base course.
 - c. If option is selected to install full-depth asphalt pavement, prepare subgrade as previously specified in this Section.
 - d. Substitute asphalt concrete for aggregate base at ratio of 1 inch of asphalt concrete to 2-1/2 inches of aggregate base material. Use full-depth asphalt pavement not less than 4 inches in thickness after compaction.
 - e. Place asphalt concrete in courses of not more than 4 inches.
 - f. Use compaction equipment in accordance with following course thicknesses:
 - 1) 1 to 2 inch thickness: Minimum 8 ton roller.
 - 2) 2 to 3 inch thickness: Minimum 10 ton roller.
 - 3) 3 to 4 inch thickness: Minimum 12 ton roller.
 - 2. Pneumatic rollers used for initial or secondary rolling: Use 12 to 15 tons with tires capable of 90 pounds per square inch inflation pressure.
 - 3. Asphalt concrete for full-depth asphalt pavement:
 - a. Asphalt concrete as previously specified in this Section.
 - b. Apply bituminous prime coats where full-depth asphalt pavement is installed.
 - c. CMAR's option: If CMAR elects to use full-depth asphalt pavement, at road shoulders reduce aggregate base course to minimum aggregate thickness of 4 inches.
 - 4. Except for asphalt thickness, aggregate base course thickness and prime coating, full-depth asphalt pavement comply with requirements of this Section.

3.03 FIELD QUALITY CONTROL

- A. Placement:
 - 1. Place the mixture on the roads, pavements, or walks at a temperature not less than 225 degrees Fahrenheit.

- B. Tests:
 - 1. Provide sampling and control testing for the asphalt concrete.
 - a. The type and size of the samples: Suitable to determine conformance with stability, density, thickness, compaction, and other specified requirements.
 - b. Use an approved power saw or core drill for cutting samples.
 - c. Furnish all tools, labor, and materials for cutting samples, testing, and replacing the pavement where samples were removed.
 - d. Take a minimum 1 sample per 200 tons of asphalt concrete placed.

- C. Inspection:
 - 1. Asphalt concrete:
 - a. Test with a 10-foot straightedge laid on the surface parallel with the centerline of the road: Variation of the surface from the testing edge of the straightedge not to exceed 1/4 inch.

END OF SECTION

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SECTION 02952

PAVEMENT RESTORATION AND REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Resurfacing roads and paved surfaces in which surface is removed or damaged by installation of new work.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. City of Daytona Beach Standard Specification and Details
<http://www.codb.us/DocumentCenter/Home/View/900>.
 - 3. It is the CONTRACTOR's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of CONTRACTOR's Work.
 - 4. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the CONTRACTOR to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 02722 - Aggregate Base Courses.
 - b. Section 02742 - Asphaltic Concrete Paving.
 - c. Section 03300 - Cast-in-Place Concrete.

1.02 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Limiting dimensions:
 - a. Determine the exact lengths and dimensions of such roads, pavements, parking areas, and walks that will require removal and replacement for new work.
 - b. Join existing surfaces to terminals of new surfacing in smooth juncture.

1.03 SUBMITTALS

- A. Mix designs:
 - 1. Prior to placement of asphalt concrete, submit full details, including design and calculations for the asphalt concrete mix proposed.
 - 2. Submit gradation of aggregate base.
 - 3. Submit proposed mix design of portland cement concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate base course: As specified in Section 02722.

- B. Asphalt pavement: As specified in Section 02742.
- C. Portland cement concrete replacement material: Class A concrete as specified in Section 03300.

2.02 EQUIPMENT

- A. Roads, pavements, parking areas, and walks:
 - 1. Equipment requirements: Good condition, capable of performing work intended in satisfactory manner.

2.03 ACCESSORIES

- A. Material for painting asphalt concrete pavement: Tack coat as specified in Section 02742.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Aggregate surface removal replacement:
 - 1. When trench cut is in aggregate surfaced areas, replace aggregate base course material with material matching existing material compacted to 95 percent of its maximum density.
- B. Pavement removal and temporary asphalt replacement:
 - 1. Install temporary asphalt pavement or first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement.
 - 2. Except as otherwise provided, maintain this temporary pavement in safe and reasonably smooth condition until required permanent pavement is installed.
 - 3. Remove and dispose of temporary paving from project site.
 - 4. Where longitudinal trench is partly in pavement, replace pavement to original pavement edge, on a straight line, parallel to centerline of roadway.
 - 5. Where no part of longitudinal trench is in pavement, surfacing replacement shall only be required where existing surfacing materials have been removed.
- C. Asphalt pavement replacement:
 - 1. Replace asphalt pavement to same thickness as adjacent pavement and match as nearly as possible adjacent pavement in texture, unless otherwise indicated on the Drawings.
 - 2. Cut existing asphalt pavements to be removed for trenches or other underground construction by wheel cutter, clay spade, or other device capable of making neat, reasonably straight, and smooth cut without damaging adjacent pavement. Cutting device operation shall be subject to acceptance of Engineer.

3. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement replacement, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt pavements. No extra payment will be made for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.
 4. Conform replacement of asphalt pavement to contour of original pavement.
- D. Curb, gutter, and sidewalk replacement:
1. Where any concrete curb, gutter, or sidewalk has been removed or displaced, replace to nearest construction joints with new Class A curb, gutter, or sidewalk to same dimensions and finish as original construction that was removed:
 - a. Provide expansion joints of same spacing and thickness as original construction.
- E. Asphalt pavements:
1. Trim existing asphalt pavements which are to be matched by pavement widening or pavement extension to neat true line with straight vertical edges free from irregularities with saw specifically designed for this purpose. Minimum allowable depth of cut shall be 1-1/2 inches.
 2. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement widening or extension, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt concrete pavements.
 3. No extra payment will be made for these items and all costs incurred in performing this work shall be incidental to widening or pavement extension.

3.02 FIELD QUALITY CONTROL

- A. Tests:
1. Asphalt concrete as specified in Section 02742.
 2. Concrete as specified in Section 03300.
- B. Inspection:
1. Asphalt concrete:
 - a. Lay 10-foot straightedge parallel to centerline of trench when the trenches run parallel to street, and across pavement replacement when trench crosses street at angle.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.
 2. Portland cement concrete replacement pavement:
 - a. Lay 10-foot straightedge either across pavement replacement or longitudinal with centerline of gutter or ditch.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.

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SECTION 03055

ADHESIVE-BONDED REINFORCING BARS AND ALL THREAD RODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Bonding reinforcing bars and all thread rods in concrete using adhesives as specified.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03200 - Concrete Reinforcing.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. Standard B212.15 - Carbide Tipped Masonry Drills and Blanks for Carbide Tipped Masonry Drills.
- B. ASTM international (ASTM):
 - 1. C 881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- C. ICC Evaluation Service, Inc. (ICC-ES):
 - 1. AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
- D. Society for Protective Coatings (SSPC):
 - 1. Surface Preparation Standards (SP)
 - a. SP-1 - Solvent Cleaning.

1.03 SUBMITTALS

- A. Product Data: Furnish technical data for adhesives, including:
 - 1. Manufacturer's printed installation instructions (MPII).
 - 2. Independent laboratory test results.
 - 3. Handling and storage instructions.
- B. Quality control submittals:
 - 1. Adhesive manufacturer's past project experience data on at least 3 similar projects supplied with proposed products within the last 3 years.

2. ICC Evaluation Service, Inc., Evaluation Services Report in compliance with the AC308-Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
3. Installer qualifications: Submit evidence of successful completion of certification program for each installer of work described in this Section.

1.04 QUALITY ASSURANCE

- A. Qualifications:
 1. Installer qualifications:
 - a. All individuals performing the work described in this Section shall be certified by a qualified organization to install adhesive anchors by following the MPII. Those organizations deemed to be qualified are:
 - 1) ACI-CRSI Adhesive Anchor Installer Certification Program.
 - 2) An adhesive anchor manufacturer's certification program, subject to acceptance by the Engineer.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and protection:
 1. Store adhesives and adhesive components on pallets or shelving in a covered-storage area.
 2. Control temperature above 60 degrees Fahrenheit and dispose of product if shelf life has expired.
 3. If stored at temperatures below 60 degrees Fahrenheit, test components prior to use to determine if they still meet specified requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. Like items of materials: Use end products of one manufacturer in order to achieve structural compatibility and singular responsibility.

2.02 ADHESIVE FOR SELF-CONTAINED CARTRIDGE SYSTEM

- A. Adhesive shall have a current ICC Evaluation Service report documenting acceptance under AC308 for use with cracked concrete and for the seismic design categories specified.
- B. Materials:
 1. In accordance with ASTM C 881, Type IV, Grade 3, Class B or C depending on site conditions.
 2. 2-component, 100 percent solids, insensitive to moisture.
 3. Cure temperature, pot life, and workability: Compatible with intended use and environmental conditions.
- C. Packaging:
 1. Furnished in side-by-side cartridges with resin and hardener components isolated until mixing through manufacturer's static mixing nozzle. Nozzle designed to thoroughly blend the components for injection from the nozzle directly into prepared hole.

2. Container markings: Include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
- D. Manufacturers: One of the following or equal:
1. Hilti, Inc., Tulsa, OK: RE 500-SD.
 2. Simpson Strong-Tie Company, Inc., Pleasanton, CA: SET-XP.

2.03 REINFORCING BARS

- A. As specified in Section 03200.

PART 3 EXECUTION

3.01 GENERAL

- A. Execution of this work is restricted to those installers certified through a qualified certification program described under Quality Assurance and accepted by the Engineer.
- B. The work shall be performed in strict accordance with the accepted MPII and the following instructions. Where the accepted MPII and the following instructions conflict, the MPII shall prevail.
- C. Provide adhesive packaged as follows:
1. Disposable, self-contained cartridge system capable of dispensing multiple adhesive components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun.
 2. Dispense components through a mixing nozzle that thoroughly mixes components.

3.02 HOLE SIZING AND INSTALLATION

- A. Drilling holes:
1. Determine location of reinforcing bars or other obstructions with a non-destructive indicator device, and mark locations with construction crayon on the surface of the concrete.
 2. Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by Engineer.
- B. Hole drilling equipment:
1. Electric or pneumatic rotary impact type with medium or light impact.
 2. Drill bits: Carbide-tipped in accordance with ANSI B212-15
 3. Hollow drill bits with flushing air systems are preferred. Air supplied to hollow drill bits shall be free of oil, water, or other contaminants that will reduce bond.
 4. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.
- C. Hole diameter: Reinforcing bar diameter or all thread rod diameter plus 1/8 inch.

- D. Obstructions in drill path:
1. If an existing reinforcing bar or other obstruction is hit while drilling hole, stop drilling hole and fill the hole with drypack mortar. Relocate the hole to miss the obstruction and drill another hole. Repeat the above until the hole has been drilled to the required depth.
 2. Avoid drilling an excessive number of holes in an area of a structural member, which would excessively weaken the structural member and endanger the stability of the structure. Drypack holes which hit obstructions and allow drypack to reach strength equal to the existing concrete before drilling adjacent holes. Epoxy grout may be substituted for drypack when acceptable to Engineer.
 3. When existing reinforcing steel is encountered during drilling and when acceptable to Engineer, enlarge the hole by 1/8 inch, core through the existing reinforcing steel at the larger diameter, and resume drilling at original hole diameter.
 4. Bent bar reinforcing bars: Where edge distances are critical, and striking reinforcing steel is likely, and if acceptable to Engineer, drill hole at 10 degree angle or less from axis of reinforcing bar or all thread rod being installed.
- E. Install reinforcing bars and all thread rods to depth, spacings, and locations as indicated on the Drawings.
1. Do not install adhesive-bonded all-thread rods or reinforcing bars in overhead applications.
- F. Cleaning holes:
1. Insert long air nozzle into hole and blow out loose dust. Use compressed air that is free of oil, water, or other contaminants that will reduce bond.
 2. Use a stiff bristle brush to vigorously brush hole to dislodge compacted drilling dust.
 3. Repeat step 1.
 4. Repeat above steps as required to remove drilling dust or other material that will reduce bond. The hole shall be clean and dry.
- G. Cleaning reinforcing bars and all thread rods:
1. Solvent clean reinforcing bar and all thread rods over the embedment length in accordance with SSPC SP-1 Solvent Cleaning. Provide an oil and grease free surface to promote bonding of adhesive to steel.
 2. Clean reinforcing bars and all thread rods over embedment length to bare metal. The reinforcing bars and all thread rods shall be free of oil, grease, paint, dirt, mill scale, rust, or other coatings that will reduce bond.
- H. Filling hole with adhesive:
1. Fill hole with adhesive before inserting the reinforcing bar or all thread rod. Fill hole with adhesive starting from bottom of hole. Fill hole without creating air voids.
 2. Fill hole with sufficient adhesive so that excess adhesive is extruded out of the hole when the reinforcing bar or all thread rod is inserted into the hole.
 3. Do not install adhesive prior to receiving adhesive manufacturer's onsite training.

3.03 MANUFACTURERS' SERVICES

- A. Furnish manufacturer's representative to conduct jobsite training for proper installation, handling, and storage of adhesive, for personnel who will perform actual installation. Engineer may attend training sessions.

END OF SECTION

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SECTION 03071

EPOXIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Epoxy.
 - 2. Epoxy gel.
 - 3. Epoxy bonding agent.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C 881 – Standard Specification for Epoxy-Resin-Base Systems for Concrete.
 - 2. C 882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - 3. D 638 - Standard Test Method for Tensile Properties of Plastics.
 - 4. D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.

1.03 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Provide epoxy materials that are new.
 - 2. Store and use products within shelf life limitations set forth by manufacturer.
 - 3. Perform and conduct work of this Section in neat orderly manner.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data completely describing epoxy materials.
 - 1. Submit evidence of conformance to ASTM C 881. Include manufacturer's designations of Type Grade, Class, and Color.
 - 2. Submit evidence that materials meet or exceed the specified physical characteristics.

- B. Quality control submittals:
 - 1. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Moisture tolerant, water-insensitive, two-component epoxy resin adhesive material containing 100 percent solids, and meeting or exceeding the performance properties specified when tested in accordance with the standards specified.
- B. Epoxy: Low viscosity product in accordance with ASTM C 881; Types I, II and V; Grade 1; Class C.
 - 1. Manufacturers: One of the following or equal:
 - a. BASF, Concrete Standard LVI.
 - b. Sika Corporation, Sikadur 35 Hi-Mod LV.
 - 2. Required properties:

Table 1: Material Properties – Epoxy.		
Property	Test Method	Required Results (“neat”)
Tensile Strength (7-day)	ASTM D 638	7,500 pounds per square inch, minimum.
Compressive Strength, (7-day)	ASTM D 695	11,000 pounds per square inch, minimum.
Bond Strength (2-day)	ASTM C 882	Concrete shall fail before failure of epoxy.
Notes:	Testing results are for materials installed and cured at a temperature between 72 and 78 degrees Fahrenheit for 7 days, unless otherwise noted.	

- C. Epoxy gel: Non-sagging product in accordance with ASTM C 881, Types I and IV, Grade 3, Class C.
 - 1. Manufacturers: One of the following or equal:
 - a. BASF, Concrete Paste LPL.
 - b. Sika Corporation, Sikadur 31, Hi-Mod Gel.
 - 2. Required properties:

Table 2 – Material Properties – Epoxy Gel.		
Property	Test Method	Required Results (“neat”)
Tensile Strength (7-day)	ASTM D 638	2,000 pounds per square inch, minimum.
Compressive Yield Strength (7-day)	ASTM D 695	8,000 pounds per square inch, minimum.
Bond Strength (14-day)	ASTM C 882	1,500 pounds per square inch, minimum..
Notes:	Testing results are for materials installed and cured at a temperature between 72 and 78 degrees Fahrenheit for 7 days, unless otherwise noted.	

- D. Epoxy bonding agent: Non-sagging product in accordance with ASTM C 881, Type II, Grade 1, Class C.
1. Manufacturers: One of the following or equal:
 - a. BASF, Concrevic Liquid LPL.
 - b. Sika Chemical Corp., Sikadur 32 Hi-Mod LPL.
 2. Required properties.

Table 3 – Material Properties – Epoxy Bonding Agent		
Property	Test Method	Required Results
Tensile Strength (7-day)	ASTM D 638	4,400 pounds per square inch, minimum.
Compressive Yield Strength (7-day)	ASTM D 695	8,300 pounds per square inch, minimum.
Bond Strength (14-days)	ASTM C 882	1,800 pounds per square inch, minimum. Concrete shall fail before failure of epoxy bonding agent.
Pot Life	-	Minimum 70 minutes at 77 degrees Fahrenheit or Minimum 90 minutes at 73 degrees Fahrenheit
Notes:	Testing results are for materials installed and cured at a temperature between 72 and 78 degrees Fahrenheit for 7 days, unless otherwise noted.	

3. If increased contact time is required for concrete placement, epoxy resin/ portland cement bonding agent may be used instead of epoxy bonding agent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install and cure epoxy materials in accordance with manufacturer's installation instructions.
- B. Epoxy:
 1. Apply in accordance with manufacturer's installation instructions.
- C. Epoxy gel:
 1. Apply in accordance with manufacturer's installation instructions.
 2. Use for vertical or overhead work, or where high viscosity epoxy is required.
 3. Epoxy gel used for vertical or overhead work may be used for horizontal work.
- D. Epoxy bonding agent:
 1. Apply in accordance with manufacturer's installation instructions.
 2. Bonding agent will not be required for filling form tie holes or for normal finishing and patching of similar sized small defects.

END OF SECTION

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SECTION 03102
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Concrete formwork.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03300 - Cast-in-Place Concrete.
 - b. Section 03600 - Grouting.
 - c. Section 07900 - Joint Sealants.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 117 - Specifications for Tolerances for Concrete Construction and Materials and Commentary.
- B. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
- C. Underwriters Laboratories (UL).

1.03 DEFINITIONS

- A. Green concrete: Concrete with less than 100 percent of the minimum specified compressive strength (f'_c).

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Design of concrete forms, falsework, and shoring in accordance with local, state, and federal regulations.
 - 2. Design forms and ties to withstand concrete pressures without bulging, spreading, or lifting of forms.

- B. Performance requirements:
 - 1. Construct forms so that finished concrete conforms to shapes, lines, grades, and dimensions indicated on the Drawings.
 - 2. It is intended that surface of concrete after stripping presents smooth, hard, and dense finish that requires minimum amount of finishing.
 - 3. Provide sufficient number of forms so that the work may be performed rapidly and present uniform appearance in form patterns and finish.
 - 4. Use forms that are clean and free from dirt, concrete, and other debris.
 - a. Coat with form release agent if required, prior to use or reuse.

1.05 SUBMITTALS

- A. Information on proposed forming system:
 - 1. Submit in such detail as the Engineer may require to assure himself that intent of the Specifications can be complied with by use of proposed system.
 - 2. Alternate combinations of plywood thickness and stud spacing may be submitted.
- B. Form release agent. NSF 61 certification prepared by NSF, Underwriters Laboratories (UL) or other, similar, nationally recognized testing laboratory acceptable to the Engineer.

1.06 QUALITY ASSURANCE

- A. Qualifications of formwork manufacturers: Use only forming systems by manufacturers having a minimum of 5 years experience, except as otherwise specified, or accepted in writing by the Engineer.
- B. Regulatory requirements: Install work of this Section in accordance with local, state, and federal regulations.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Forms: Built-up plywood:
 - 1. Built-up plywood forms may be substituted for prefabricated forming system subject to following minimum requirements:
 - a. Size and material:
 - 1) Use full size 4-foot by 8-foot plywood sheets, except where smaller pieces are able to cover entire area.
 - 2) Sheet construction: 5-ply plywood sheets, 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.
 - b. Wales: Minimum 2-inch by 4-inch lumber.
 - c. Studding and wales: Contain no loose knots and be free of warps, cups, and bows.

- B. Forms: Steel or steel framed:
 - 1. Steel forms:
 - a. Rigidly constructed and capable of being braced for minimum deflection of finish surface.
 - b. Capable of providing finish surfaces that are flat without bows, cups, or dents.
 - 2. Steel framed plywood forms:
 - a. Provide forms that are rigidly constructed and capable of being braced.
 - b. Plywood paneling: 5-ply, 5/8-inch nominal or 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.
- C. Form release agent.
 - 1. Effective, non-staining, bond-breaking coating compatible with form surfaces and concrete mixes used.
 - 2. Certified for conformance to NSF 61 and leaving no taste or odor on the concrete surface.
- D. Form ties:
 - 1. General:
 - a. Provide form ties for forming system selected that are manufactured by recognized manufacturer of concrete forming equipment.
 - b. Do not use wire ties or wood spreaders of any form.
 - c. Provide ties of type that accurately tie, lock, and spread forms.
 - d. Provide form ties of such design that when forms are removed, they locate no metal or other material within 1-1/2 inches of the surface of the concrete.
 - e. Do not allow holes in forms for ties to allow leakage during placement of concrete.
 - 2. Cone-snap ties:
 - a. Cone-snap ties shall form a cone shaped depression in the concrete with minimum diameter of 1 inch at the surface of the concrete and minimum depth of 1-1/2 inches.
 - b. Provide neoprene waterseal washer that is located near the center of the concrete.
 - 3. Taper ties:
 - a. Neoprene plugs for taper tie holes: Size so that after they are driven, plugs are located in center third of wall thickness.
- E. Incidentals:
 - 1. External angles:
 - a. Where not otherwise indicated on the Drawings, provide with 3/4-inch bevel, formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, slabs, walls, beams, columns, and openings.
 - b. Provide 1/4-inch bevel formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, walls, and slabs at expansion and construction joints.
 - 2. Keyways: Steel, plastic, or lumber treated with form release agent.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site verification of conditions:
 - 1. Do not place concrete until forms have been checked for alignment, level, and strength, and mechanical and electrical inserts or other embedded items for correct location.

3.02 INSTALLATION

- A. Forms: Built-up plywood:
 - 1. Studding:
 - a. Spaced at 16 inches or 24 inches on center.
 - b. Closer spacing may be required depending upon strength requirements of the forms, in order to prevent any bulging surfaces on faces of finished concrete work.
 - c. Install studs perpendicular to grain of exterior plys of plywood sheets.
 - 2. Wales: Form wales of double lumber material with minimum size as specified in this Section.
 - 3. Number of form reuses: Depends upon durability of surface coating or overlay used, and ability to maintain forms in condition such that they are capable of producing flat, smooth, hard, dense finish on concrete when stripped.
- B. Forms: Steel or steel framed:
 - 1. Steel forms:
 - a. Adequately brace forms for minimum deflection of finish surface.
 - 2. Steel framed plywood forms:
 - a. Rigidly construct and brace with joints fitting closely and smoothly.
 - b. Number of form reuses: Depends upon durability of surface coating or overlay used.
 - 3. Built-up plywood forms: As specified in this Section may be used in conjunction with steel forms or steel framed plywood forms for special forming conditions such as corbels and forming around items which will project through forms.
- C. Forms: Incidental construction:
- D. Form bracing and alignment:
 - 1. Line and grade: Limit deviations to tolerances which will permit proper installation of structural embedded items or mechanical and electrical equipment and piping.
 - 2. Formwork:
 - a. Securely brace, support, tie down, or otherwise hold in place to prevent movement.
 - b. Make adequate provisions for uplift pressure, lateral pressure on forms, and deflection of forms.
 - 3. When second lift is placed on hardened concrete: Take special precautions in form work at top of old lift and bottom of new lift to prevent:
 - a. Spreading and vertical or horizontal displacement of forms.
 - b. Grout "bleeding" on finish concrete surfaces.
 - 4. Pipe stubs, anchor bolts, and other embedded items: Set in forms where required.

5. Cracks, openings, or offsets at joints in formwork: Close those that are 1/16-inch or larger by tightening forms or by filling with acceptable crack filler.
- E. Forms: Incidentals:
1. Keyways: Construct as indicated on the Drawings.
 2. Reentrant angles: May be left square.
 3. Level strips: Install at top of wall concrete placements to maintain true line at horizontal construction joints.
 4. Inserts:
 - a. Encase pipes, anchor bolts, steps, reglets, castings, and other inserts, as indicated on the Drawings or as required, in concrete.
 5. Pipe and conduit penetrations:
 - a. Install pipe and conduit in structures as indicated on the Drawings, and seal with materials as specified in Section 07900.
- F. Form release agent:
1. Apply in accordance with manufacturer's instructions.
- G. Form ties:
1. Cone-snap ties: Tie forms together at not more than 2-foot centers vertically and horizontally.

3.03 FORM REMOVAL

- A. Keep forms in place for at least the periods indicated in the following paragraphs.
1. Vertical forms:
 - a. Keep vertical forms in place for a minimum of 24 hours after concrete is placed.
 - b. If, after 24 hours, concrete has sufficient strength and hardness to resist surface or other damage, forms may be removed.
 2. Other forms and shoring: Keep in place:
 - a. Sides of footings: 24 hours minimum.
 - b. Vertical sides of beams, girders, and similar members: 48 hours minimum.
 - c. Bottom of slabs, beams, and girders: Until concrete strength reaches specified strength f'_c or until shoring is installed.
 - d. Shoring for slabs, beams, and girders: Shore until concrete strength reaches specified strength.
 - e. Wall bracing: Brace walls until concrete strength of beams and slabs laterally supporting wall reaches specified strength.
- B. Green concrete:
1. No heavy loading on green concrete will be permitted.

3.04 SURFACE REPAIRS AND FINISHING

- A. Immediately after forms are removed, the Contractor shall schedule an inspection and shall repair any irregularities in surfaces and finishes as specified in Section 03300.
- B. Form ties: Remove form ties from surfaces. Fill tie holes as follows:
1. Remove form ties from surfaces.
 2. Roughen cone shaped tie holes by heavy sandblasting before repair.

3. Dry pack cone shaped tie holes with dry-pack mortar as specified in Section 03600.
4. Taper ties:
 - a. After forms and taper ties are removed from wall, plug tie holes with neoprene plug as follows:
 - 1) Heavy sandblast and then clean tie holes.
 - 2) After cleaning, drive neoprene plug into each of taper tie holes with steel rod. Final location of neoprene plug shall be in center third of wall thickness. Bond neoprene plug to concrete with epoxy.
 - 3) Locate steel rod in cylindrical recess and against middle of plug during driving.
 - a) At no time are plugs to be driven on flat area outside cylindrical recess.
 - b. Dry-pack of taper tie holes:
 - 1) After installing plugs in tie holes, coat tie hole surface with epoxy bonding agent and fill with dry-pack mortar as specified in Section 03600.
 - a) Place dry-pack mortar in holes in layers with thickness not exceeding tie hole diameter and heavily compact each layer.
 - b) Dry-pack the outside of the hole no sooner than 7 days after the inside of the hole has been dry packed.
 - c) Wall surfaces in area of dry-packed tie holes: On the water side of water containing structures and the outside of below grade walls:
 - (1) Cover with minimum of 10 mils of epoxy gel.
 - (2) Provide epoxy gel coating on wall surfaces that extend minimum of 2 inches past dry-pack mortar filled tie holes.
 - (3) Provide finish surfaces that are free from sand streaks or other voids.

3.05 TOLERANCES:

- A. Finished concrete shall conform to shapes, lines, grades, and dimensions indicated on the Drawings.
- B. Construct work within the tolerances in accordance with ACI 117, except as modified in the following paragraphs or as indicated on the Drawings.
 1. General:
 - a. At certain locations in the Work, tolerances required for equipment placement and operation may be more restrictive than the general tolerance requirements of this Section.
 - b. Confirm equipment manufacturers' required tolerances for location and operation of equipment that will be installed, and construct concrete to satisfy those requirements.
 2. Slabs:
 - a. Slope: Uniformly sloped to drain when slope is indicated on the Drawings.
 - b. Slabs indicated to be level: Have maximum vertical deviation of 1/8-inch in 10-foot horizontal length without any apparent changes in grade.
 3. Circular tank walls:
 - a. The Contractor may deviate from finish line indicated on the Drawings by use of forms with chord lengths not to exceed 2 feet.
 4. Inserts and embedments:

- a. Set inserts and embedments to tolerances required for proper installation and operation of equipment or systems to which insert pertains.
- b. Maximum tolerances: As follows:

Item	Tolerance
Sleeves and inserts	Plus 1/8 Minus 1/8 inches.
Anchor bolts:	
Projected ends	Plus 1/4 Minus 0.0 inches.
Axial alignment	Not more than 2 degrees off the axis indicated on the Drawings.
Setting location	Plus 1/16 Minus 1/16 inches.

- C. Remove and replace work that does not conform to required tolerances. Procedures and products employed in and resulting from such re-work shall be acceptable to the Engineer.

END OF SECTION

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SECTION 03150

CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Waterstops.
 - 2. Joint fillers.

- B. Related sections:
 - 1. The Contract Drawings are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of the Contractor's Work.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 570 - Standard Test Method for Water Absorption of Plastics.
 - 2. D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 3. D 638 - Standard Test Method for Tensile Properties of Plastics.
 - 4. D 746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 5. D 747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
 - 6. D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 7. D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 8. D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - 9. D 2240 - Standard Test Method for Rubber Property – Durometer Hardness.

- B. American National Standards Institute (ANSI):
 - 1. A135.4 - Basic Hardboard.

- C. U. S. Army Corps of Engineers (USACE):
 - 1. CRD-C-572, Specification for Polyvinyl Chloride Waterstop.

1.03 SUBMITTALS

- A. Product data:
 - 1. Stainless steel waterstop: Complete physical properties outlined in this Section and in accordance with ASTM A 240 and ASTM A 370.

2. Preformed expansion joint material: Sufficient information on each type of material for review to determine conformance of material to requirements specified.
- B. Samples:
1. Stainless steel waterstop.
- C. Laboratory test reports: Indicating that average properties of polyvinyl chloride waterstops material and finish conform to requirements specified in this Section.
- D. Quality control submittals:
1. Certificates of Compliance:
 2. Manufacturer's instructions: For materials specified in this Section that are specified to be installed with such instructions.

1.04 QUALITY ASSURANCE

- A. Mock-ups:
1. Welding demonstration:
 - a. Demonstrate ability to weld acceptable joints in stainless steel waterstop before installing waterstop in forms.
- B. Inspections:
1. Quality of welded joints will be subject to acceptance of Engineer.

PART 2 PRODUCTS

2.01 JOINT FILLERS

- A. General:
1. Use specific type in applications as indicated on the Drawings.
 2. Do not use scrap or recycled materials to manufacture joint fillers.
- B. Preformed expansion joint materials:
1. Bituminous fiber expansion joint material:
 - a. Properties:
 - 1) Thickness: To match joint width indicated on the Drawings.
 - 2) Asphalt-impregnated fiber in accordance with ASTM D 1751.
 - b. Manufacturers: One of the following or equal:
 - 1) Durajoint.
 - 2) W.R. Meadows, SealTight Fibre Expansion Joint.
 2. Synthetic sponge rubber expansion joint material:
 - a. Properties:
 - 1) Thickness: As recommended for width indicated on the Drawings.
 - 2) Material in accordance with ASTM D 1752, Type I.
 - b. Manufacturers: One of the following or equal:
 - 1) Durajoint.
 - 2) W.R. Meadows, SealTight Sponge Rubber.

2.02 WATERSTOPS

- A. Waterstops - stainless steel:
1. Non-expansion joint type.
 2. Fabrication: Provide shop-fabricated waterstop fittings for all intersections. Directional changes shall be miter cut and spliced by TIG welding to maintain continuity of the outside flanges and "V" expansion zone.
 3. Manufacturers: One of the following or equal:
 - a. JP Specialties, Inc., JP558.
 - b. Greenstreak Plastic Products Company, Style 499.
 4. Type 316L stainless steel waterstops shall comply with the following requirements:
 - a. Non-expansion joint type stainless steel waterstops:
 - 1) 6-inch wide, 20 gauge, in accordance with ASTM A 240 Type 316L or Type 316 ELC.
 - b. Properties as indicated in the following table.

Physical Characteristics	Test Method	Required Results
Minimum Ultimate Tensile Strength	ASTM A 370	75,000 pounds per square inch
Elongation in 2-Inch Minimum	ASTM A 370	40 percent
Rockwell B Hardness	ASTM A 370	95 maximum
Minimum Yield Strength	ASTM A 370	25,000 pounds per square inch

PART 3 EXECUTION

3.01 INSTALLATION

- A. Waterstops:
1. General:
 - a. Store waterstops so as to permit free circulation of air around waterstop material and prevent direct exposure to sunlight.
 - b. Install waterstops in concrete joints where indicated on the Drawings.
 - c. Carry waterstops in walls into lower slabs and join to waterstops in slabs with appropriate types of fittings.
 - d. In waterbearing structures: Provide all joints with waterstops, whether indicated on the Drawings or not.
 - e. Provide waterstops that are continuous.
 - f. Set waterstops accurately to position and line as indicated on the Drawings.
 - g. Hold and securely fix edges in position at intervals of not more than 24 inches so that they do not move during placing of concrete.
 - h. Position the waterstop so that symmetrical halves of waterstop are equally divided between concrete pours. Center axis of waterstop shall be coincident with centerline of the joint.
 - i. Do not drive nails, screws, or other fasteners through waterstops in vicinity of construction joints.
 - j. Use wires at not more than 24 inches on centers near outer edge of waterstop to tie waterstops into position.
 - k. Special clips may be used in lieu of wires, at Contractor's option.

- l. Terminate waterstops 3 inches from top of finish surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.
 - m. When any waterstop is installed in concrete on one side of joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, take suitable precautions to shade and protect exposed waterstop from direct rays of sunlight during entire exposure and until exposed portion is embedded in concrete.
 - n. When placing concrete at waterstops in slabs, lift edge of waterstop while placing concrete below the waterstop. Manually force waterstop against and into concrete, and then cover waterstop with fresh concrete.
2. Stainless steel waterstops:
- a. Weld splices in stainless steel waterstops using TIG or MIG welding process utilizing filler metal or filler metal electrode to match stainless type. Weld all straight run material edge-to-edge with no overlapping.
 - b. Repair damaged waterstops by removing damaged portions and patching. Patching shall overlap a minimum of 1 inch onto undamaged portion of waterstop.
 - c. Ensure back side (or open end of the "V") is covered completely with tape prior to concrete pour.
- B. Joints:
- 1. Construct construction and expansion joints as indicated on the Drawings.
 - 2. Preformed expansion joint material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

END OF SECTION

SECTION 03200

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Bar supports.
 - 2. Reinforcing bars.
 - 3. Thread bars.
 - 4. Tie wires.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 318 - Building Code Requirements for Structural Concrete and Commentary.
 - 2. 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - 3. SP-66 – ACI Detailing Manual.
- B. American Welding Society (AWS):
 - 1. D1.4 - Structural Welding Code - Reinforcing Steel.
- C. ASTM International (ASTM):
 - 1. A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - 2. A 615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 - 3. A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

1.03 DEFINITIONS

- A. Give away bars: Bars that are not required by Contract Documents, but are installed by the Contractor to support the required reinforcing bars.

1.04 SYSTEM DESCRIPTION

- A. The Drawings contain general notes concerning amount of reinforcement and placing, details of reinforcement at wall corners and intersections, and details of extra reinforcement around openings in concrete.

1.05 SUBMITTALS

- A. Shop drawings:
 - 1. Changes to reinforcing steel contract drawing requirements:
 - a. Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.

- b. Such changes will not be acceptable unless the Engineer has accepted such changes in writing.
 - 2. Reinforcement shop drawings:
 - a. Review of reinforcement shop drawings by the Engineer will be limited to general compliance with the Contract Documents.
 - b. Submit reinforcement shop drawings in a complete package for each specific structure. Partial submittals will be rejected.
- B. Samples:
 - 1. Bar support chairs: Submit samples of chairs proposed for use along with letter stating where each type of chair will be used.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping:
 - 1. Deliver bars bundled and tagged with identifying tags.
- B. Acceptance at site:
 - 1. Reinforcing bars: Deliver reinforcing bars lacking grade identification marks accompanied by manufacturer's guarantee of grade.

1.07 SEQUENCING AND SCHEDULING

- A. Bar supports: Do not place concrete until samples and product data for bar supports have been accepted by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Bar supports:
 - 1. Wire bar supports located between reinforcing bars and face of concrete:
 - a. Hot-dip galvanized steel bar support chairs with plastic tips.
 - 1) Support reinforcing for concrete placed on ground using bar support chairs with hot dip galvanized plates for resting on ground welded to the chairs.
 - 2. Wire bar supports located between mats of reinforcing bar:
 - a. Steel bar supports.
- B. Reinforcing bars:
 - 1. Reinforcing bars to be embedded in concrete:
 - a. ASTM A 615 Grade 60 deformed bars.
 - 1) Actual yield strength based on mill tests of reinforcement provided shall not exceed the minimum yield strength specified in this Section by more than 18,000 pounds per square inch.
 - 2) Ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement shall not be less than 1.25.
- C. Tie wires: Annealed steel.
- D. Welded wire fabric reinforcement:
 - 1. In accordance with ASTM A 185.

2. Fabric may be used in place of reinforcing bars if accepted by the Engineer.
3. Provide welded wire fabric in flat sheet form.
4. Provide welded wire fabric having cross-sectional area per linear foot of not less than cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

2.02 FABRICATION

- A. Shop assembly:
 1. Cut and bend bars in accordance with provisions of ACI 318, ACI 350, and ACI SP-66.
 2. Bend bars cold.
 3. Provide bars free from defects and kinks and from bends not indicated on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions:
 1. Reinforcing bars and welded wire fabric reinforcement: Verify that reinforcement is new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

3.02 PREPARATION

- A. Surface preparation:
 1. Reinforcing bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.
 2. Cleaning of reinforcement materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

3.03 INSTALLATION

- A. Reinforcing bars:
 1. No field bending of bars will be allowed.
 2. Hoop bars shall be rolled to the radius of the structure.
 3. Welding:
 - a. Weld reinforcing bars where indicated on the Drawings or acceptable to the Engineer.
 - b. Perform welding in accordance with AWS D1.4 and welding procedures accepted by the Engineer.
 - 1) Conform to requirements for minimum preheat and interpass temperatures.
 - c. Submit welding procedures.
 - d. Do not tack weld reinforcing bars.

B. Placing reinforcing bars:

1. Accurately place bars to meet tolerances of ACI 318 and adequately secure them in position.
2. Lap bars at splices as indicated on the Drawings or specified.
 - a. Unless specifically otherwise indicated on the Drawings, install bars at lap splices in contact with each other and fasten together with tie wire.
 - b. Where reinforcing bars are to be lap spliced at concrete joints, ensure that bars project from first concrete placement a length equal to or greater than the minimum lap splice length indicated on the Drawings.
 - c. Where lap splice lengths are not indicated on the Drawings, provide lap splice lengths in accordance with ACI 318 and ACI 350.
3. Bar supports:
 - a. Provide a sufficient number to prevent sagging, to prevent shifting, and to support loads during construction; but in no case less than quantities and at locations as indicated in ACI SP-66.
 - b. Do not use brick, broken concrete masonry units, spalls, rocks, wood or similar materials for supporting reinforcing steel.
 - c. Do not use give away bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to the give away bars.
4. If not indicated on the Drawings, provide protective concrete cover in accordance with ACI 350 and ACI SP-66.

C. Tying of bar reinforcement:

1. Fasten bars securely in place with wire ties.
2. Tie bars sufficiently often to prevent shifting.
3. Provide at least 3 ties in each bar length.
 - a. Do not apply to dowel lap splices or to bars shorter than 4 feet, unless necessary for rigidity.
4. Tie slab bars at every intersection around periphery of slab.
5. Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

Bar Size	Slab Bar Spacing Inches	Wall Bar Spacing Inches
Bars Number 5 and Smaller	60	48
Bars Number 6 through Number 9	96	60
Bars Number 10 and Number 11	120	96

6. After tying wire ties, bend ends of wire ties in towards the center of the concrete section.
 - a. The cover for wire ties shall be the same as the cover requirements for reinforcing bars.

D. Welded wire fabric reinforcement:

1. Install necessary wiring, spacing chairs, or supports to keep welded wire fabric in place while concrete is being placed.
2. Bend fabric as indicated on the Drawings or required to fit work.
3. Unroll or otherwise straighten fabric to make flat sheet before placing in the Work.
4. Lap splice welded wire fabric as indicated on the Drawings.

5. If lap splice length is not indicated on the Drawings, splice fabric in accordance with ACI 318 and ACI 350.

END OF SECTION

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SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Cast-in-place concrete.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03071 - Epoxies.
 - b. Section 03150 - Concrete Accessories.
 - c. Section 03366 - Tooled Concrete Finishing.
 - d. Section 03600 - Grouting.
 - e. Section 03931 - Epoxy Injection System.
 - f. Section 07900- Joint Sealants.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 305 - Hot Weather Concreting Standard.
 - 2. 306 - Cold Weather Concreting Standard.
 - 3. 318 - Building Code Requirements for Structural Concrete and Commentary.
 - 4. 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - 5. Manual of Concrete Practice.
- B. ASTM International (ASTM):
 - 1. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C 33 - Standard Specification for Concrete Aggregates.
 - 3. C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
 - 5. C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 6. C 88 - Standard Test Method of Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - 7. C 94 - Standard Specification for Ready-Mixed Concrete.
 - 8. C 114 - Standard Test Methods for Chemical Analysis of Hydraulic Cement.

9. C 117 - Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
10. C 123 - Standard Test Method for Lightweight Particles in Aggregate.
11. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
12. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
13. C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregate.
14. C 143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
15. C 150 - Standard Specification for Portland Cement.
16. C 156 - Standard Test Method for Water Loss from a Mortar Specimen Through Liquid Membrane-Forming Curing Compounds for Concrete.
17. C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
18. C 171 - Standard Specifications for Sheet Materials for Curing Concrete.
19. C 172 - Standard Practice for Sampling Freshly Mixed Concrete.
20. C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
21. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
22. C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
23. C 295 - Standard Guide to Petrographic Examination of Aggregates for Concrete.
24. C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
25. C 311 - Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
26. C 494 - Standard Specification for Chemical Admixtures for Concrete.
27. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
28. C 856 - Standard Practice for Petrographic Examination of Hardened Concrete.
29. D 75 - Standard Practice for Sampling Aggregates.
30. D 2103 - Standard Specification for Polyethylene Film and Sheeting.

C. NSF International (NSF):

1. 61 - Drinking Water System Components - Health Effects.

1.03 DEFINITIONS

- A. Alkali: Sum of sodium oxide and potassium oxide calculated as sodium oxide.
- B. Cementitious materials: Portland cement and fly ash.
- C. Cold weather: A period when for more than 3 consecutive days, the average daily outdoor temperature drops below 40 degrees Fahrenheit. The average daily temperature is the average of the highest and lowest temperatures during the period from midnight to midnight. When temperatures above 50 degrees Fahrenheit occur during more than half of any 24-hour duration, the period shall no longer be regarded as cold weather.

- D. Cold weather concreting: Operations for placing, finishing, curing, and protection of concrete during cold weather.
- E. Green concrete: Concrete with less than 100 percent of the specified strength.
- F. Hairline crack: Crack with a crack width of less than 4 thousandths of an inch.
- G. Hot weather: A period when project conditions such as low humidity, high temperature, solar radiation, and high winds, promote rapid drying of freshly placed concrete.
- H. Hot weather concreting: Operations for placing, finishing, curing, and protection of concrete during hot weather.

1.04 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. General:
 - a. Except as otherwise specified, provide concrete composed of portland cement, fly ash, fine aggregate, coarse aggregate, admixtures and water so proportioned and mixed as to produce plastic, workable mixture in accordance with requirements as specified in this Section and suitable to specific conditions of placement.
 - b. Proportion materials in a manner that will secure lowest water-cementitious materials ratio that is consistent with good workability, plastic and cohesive mixture, and a mixture that is within specified slump range.
 - c. Proportion fine and coarse aggregates in manner such as not to produce harshness in placing or honeycombing.
 - 2. It is the intent of this Section to secure for every part of the Work concrete with homogeneous mixture, which when hardened will have required strength, watertightness, and durability:
 - a. It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces.
 - b. Construction and expansion have been specified and positioned in structures as indicated on the Drawings, and curing methods specified, for purpose of reducing number and size of cracks, due to normal expansion and contraction expected from specified concrete mixes.
 - c. Repair cracks which develop in walls or slabs and repair cracks which show any signs of leakage until all leakage is stopped.
 - d. Pressure inject visible cracks, other than hairline cracks and crazing, in following areas with epoxy as specified in Section 03931:
 - 1) Floors and walls of water bearing structures.
 - 2) Walls and overhead slabs of passageways or occupied spaces, outsides of which are exposed to weather or may be washed down and are not specified to receive separate waterproof membrane.
 - 3) Other items not specified to receive separate waterproof membrane: Slabs over water channels, wet wells, reservoirs, and other similar surfaces.
 - e. Walls or slabs, as specified above, that leak or sweat because of porosity or cracks too small for successful pressure injection with epoxy: Seal on water or weather side by coatings of surface sealant system, as specified in this Section.

- f. Pressure injection and sealing: Continue as specified above until structure is watertight and remains watertight for not less than 1 year after final acceptance or date of final repair, whichever occurs later in time.
3. Workmanship and methods: Provide concrete work, including detailing of reinforcing, conforming with best standard practices and as set forth in ACI 318, ACI 350, Manual of Concrete Practices, and recommended practices.

1.05 SUBMITTALS

- A. Cement mill tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.
- B. Cold weather concreting:
 1. Procedures for the production, transportation, placement, protection, curing, and temperature monitoring for concrete during cold weather.
 2. Procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
- C. Concrete mixes: Full details, including mix design calculations for concrete mixes proposed for use for each class of concrete:
 1. Include information on correction of batching for varying moisture contents of fine aggregate.
 2. Source quality test records with mix design submittal:
 - a. Include calculations for required compressive strength (f'_{cr}) based on source quality test records.
- D. Concrete aggregate tests: Certified copies in triplicate of commercial laboratory tests not more than 90 days old of all samples of concrete aggregates:
 1. Coarse aggregate:
 - a. Abrasion loss.
 - b. Clay lumps and friable particles.
 - c. Coal and lignite.
 - d. Materials finer than 200 sieve.
 - e. Reactivity.
 - f. Shale and chert.
 - g. Soundness.
 2. Fine aggregate:
 - a. Clay lumps.
 - b. Color.
 - c. Decantation.
 - d. Reactivity.
 - e. Shale and chert.
 - f. Soundness.
- E. Drying shrinkage test data. The drying shrinkage limit shall be 0.05 percent at 28 days. Data submitted shall be measured to the nearest 0.001 percent.
- F. Fine or coarse aggregate batched from more than 1 bin: Analyses for each bin, and composite analysis made up from these, using proportions of materials to be used in mix.

- G. Fly ash Certificate of Compliance: Identify source of fly ash and certify compliance in accordance with ASTM C 618.
- H. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Corrective measures for use prior to placing concrete.
- I. Hot weather concreting: Procedures for production, placement, finishing, curing, protection, and temperature monitoring for concrete during hot weather and appropriate corrective measures.
- J. Heating equipment for cold weather concreting: Information on type of equipment used for heating materials and new concrete in process of curing during excessively cold weather.
- K. Information on mixing equipment.
- L. Product data: Submit data completely describing products.
- M. Sequence of concrete placing: Submit proposed sequence of placing concrete showing proposed beginning and ending of individual placements.
- N. Sieve analysis: Submit sieve analyses of fine and coarse aggregates being used in triplicate at least every 3 weeks and at any time there is significant change in grading of materials.
- O. Trial batch test data:
 - 1. Submit data for each test cylinder.
 - 2. Submit data that identifies mix and slump for each test cylinder.
- P. Weather monitoring: Records of:
 - 1. Relative humidity.
 - 2. Site ambient temperature.
 - 3. Wind speed.
- Q. Temperature of freshly placed concrete.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping:
 - 1. Deliver, store, and handle concrete materials in manner that prevents damage and inclusion of foreign substances.
 - 2. Deliver and store packaged materials in original containers until ready for use.
 - 3. Deliver aggregate to mixing site and handle in such manner that variations in moisture content will not interfere with steady production of concrete of specified degree of uniformity and slump.
- B. Acceptance at site: Reject material containers or materials showing evidence of water or other damage.

1.07 PROJECT CONDITIONS

- A. Environmental requirements:

1. Monitoring weather conditions:
 - a. Install an outdoor weather station capable of measuring and recording ambient temperature, wind speed, and humidity. Furnish instruments accurate to within 2 degrees Fahrenheit, 5 percent relative humidity, and 1 mile per hour wind speed.
 - b. Measure and record temperature of fresh concrete. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature of concrete.
 - c. Monitor and keep records of the weather forecast starting at least 48 hours prior to placing concrete in order to allow enough time for taking appropriate measures pertaining to Hot or Cold weather concreting.
2. Hot weather concreting:
 - a. Initiate evaporation control measures when concrete and air temperatures, relative humidity of the air, and the wind velocity have the capacity to evaporate water from a free surface at a rate that is equal to or greater than 0.2 pounds per square feet per hour. Determine evaporation rate using the Menzel Formula and monograph in ACI 305 3.1.3.
 - b. When ambient air temperature is above 85 degrees Fahrenheit: Prior to placing concrete, cool forms and reinforcing steel by water cooling to below 90 degrees Fahrenheit.
 - c. Monitor weather conditions at the site including air temperature, humidity, and wind speed, to assess the need for evaporation control measures begin monitoring site conditions no later than 1 hour before the start of concrete placement. Continue to monitor site conditions at intervals of 30 minutes until concrete curing has begun.
 - d. Temperature of concrete mix at time of placement: Keep temperature below 90 degrees Fahrenheit by methods which do not impair quality of concrete.
 - e. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Take corrective measures to minimize rapid water loss from concrete:
 - f. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature around concrete.
3. Cold weather concreting:
 - a. Concrete placed below ambient air temperature of 45 degrees Fahrenheit and falling or below 40 degrees Fahrenheit:
 - 1) Make provision for heating water.
 - b. Follow recommendations of ACI 306 for preparation, placement, and protection of concrete during cold weather.
 - c. If materials have been exposed to freezing temperatures to degree that any material is below 35 degrees Fahrenheit: Heat such materials.
 - d. Heating water, cement, or aggregate materials:
 - 1) Do not heat in excess of 160 degrees Fahrenheit.
 - e. Protection of concrete in forms:
 - 1) Do not remove forms from concrete when outside ambient air temperature is below 50 degrees Fahrenheit until concrete has attained its minimum specified compressive strength. Evidence of strength shall be based on by testing of cylinders stored in the field under equivalent conditions to those at the concrete structure.
 - 2) Protect by means of covering with tarpaulins, or other acceptable covering acceptable to Engineer.

- 3) Provide means for circulating warm moist air around forms in manner to maintain temperature of 50 degrees Fahrenheit for at least 5 days.

1.08 SEQUENCING AND SCHEDULING

- A. Schedule placing of concrete in such manner as to complete any single placing operation to construction or expansion joint.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Admixtures:
 1. General:
 - a. Do not use admixtures of any type, except as specified, unless written acceptance has been obtained from the Engineer.
 - b. Admixtures shall be compatible with concrete and other admixtures. Admixtures other than pozzolans shall be the products of a single manufacture to ensure compatibility.
 - c. Do not use admixtures containing chlorides calculated as chloride ion in excess of 0.5 percent by weight of cement.
 - d. Use in accordance with manufacturer's recommendations. Add each admixture to concrete mix separately.
 2. Air entraining admixture:
 - a. Provide concrete with 5 percent, within 1 percent, entrained air of evenly dispersed air bubbles at time of placement.
 - b. In accordance with ASTM C 260.
 3. Water reducing admixture:
 - a. May be used at the Contractor's option.
 - b. In accordance with ASTM C 494, Type A or Type D.
 - c. Not contain air-entraining agents.
 - d. Liquid form before adding to the concrete mix.
 - e. No decrease in cement is permitted as result of use of water reducing admixture.
 4. Super-plasticizers: Are not to be used without acceptance by Engineer.
- B. Aggregate:
 1. General:
 - a. Provide concrete aggregates that are sound, uniformly graded, and free of deleterious material in excess of allowable amounts specified.
 - b. Grade aggregate in accordance with ASTM C 136 and D 75.
 - c. Provide unit weight of fine and coarse aggregate that produces in place concrete with weight of not less than 140 pounds per cubic foot.
 - d. Do not use aggregate made from recycled materials such as crushed and screened hydraulic-cement concrete, brick, and other construction materials.
 2. Fine aggregate:
 - a. Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.
 - b. Do not provide aggregate having deleterious substances in excess of following percentages by weight of contaminating substances.
 - 1) In no case shall total exceed percent listed.

<u>Item</u>	<u>Test Method</u>	<u>Percent</u>
Removed by decantation (dirt, silt, etc.)	ASTM C 117	3
Shale or Chert	ASTM C 123 ASTM C 295*	1 1
Clay Lumps	ASTM C 142	1
* Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles are shale or chert. If the results of Test Method C 123 are less than 1 percent, Test Method C 295 is not required.		

- c. Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with ASTM C 33.
3. Coarse aggregate:
- a. Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
 - b. Not exceeding 15 percent by weight, of thin or elongated pieces having length greater than 5 times average thickness.
 - c. Deleterious substances: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.

Item	Test Method	Percent
Shale or chert	ASTM C 123 ASTM C 295**	1.25 1
Coal and lignite	ASTM C 123	1/4
Clay lumps and friable particles	ASTM C 142	1/4
Materials finer than Number 200 sieve	ASTM C 117	1/2*
* Except when material finer than Number 200 sieve consists of crusher dust, maximum amount shall be 1 percent.		
** Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles are shale, chert, coal, or lignite. If the results of Test Method C 123 are less than 1.25 percent (the minimum combined percentage of shale, chert, coal and lignite), Test Method C 295 is not required.		

- d. Grading:
- 1) Aggregate for Class A, B, C, and D concrete: In accordance with ASTM C 33, Size Number 57, except as otherwise specified or authorized in writing by the Engineer.
 - 2) Aggregate for Class CE concrete for encasement of electrical conduits:
 - a) Graded in accordance with ASTM C 33, Size Number 8.

- C. Concrete Sealer:
 - 1. Surecoat 1007 by Surecoat Systems.
- D. Concrete Stain Repellent:
 - 1. Surecoat Stain Repellent by Surecoat Systems.
- E. Conduit encasement coloring agent:
 - 1. Color: Red color concrete used for encasement of electrical ducts, conduits, and similar type items.
 - 2. Manufacturers: One of the following or equal:
 - a. Davis Company, #100 Utility Red.
 - b. I. Reiss Company, Inc., equivalent product.
 - c. Euclid Chemical Company, Increte Division, "Colorcrete Brick Red."
 - 3. Conduit encasement concrete: Mix into each cubic yard of concrete 10 pounds of coloring agent.
- F. Evaporation retardant:
 - 1. Manufacturers: One of the following or equal:
 - a. BASF, Cleveland, Ohio, Confilm.
 - b. Euclid Chemical Company, Cleveland, Ohio, Eucobar.
- G. Fly ash:
 - 1. Fly ash in accordance with ASTM C 618, Class F may be used in concrete made with Type II portland cement.
 - 2. Maximum of 15 percent by weight of fly ash to total weight of cementitious materials.
 - a. The total weight of cementitious materials shall not be less than minimum cementitious materials listed in Table A.
 - 3. Do not use in concrete made with portland-pozzolan cement.
 - 4. Loss on ignition: Not exceed 4 percent.
 - 5. In accordance with NSF 61.
- H. Keyway material: Steel, plastic, or lumber.
- I. Nonslip abrasive:
 - 1. Aluminum oxide abrasive size 8/16, having structure of hard aggregate that is, homogenous, nonglazing, rustproof, and unaffected by freezing, moisture, or cleaning compounds.
 - 2. Manufacturers: One of the following or equal:
 - a. Exolon Company, Tonawanda, New York.
 - b. Abrasive Materials, Incorporated, Hillsdale, Michigan.
 - c. "Non-Slip Aggregate", Euclid Chemical Company, Cleveland, Ohio.
- J. Portland cement:
 - 1. Conform to specifications and tests in accordance with ASTM C 150, Types II or III, low alkali, except as specified otherwise.
 - 2. Have total alkali containing not more than 0.60 percent.
 - 3. Exposed concrete in any individual structure: Use only one brand of portland cement.
 - 4. Cement for finishes or repairs: Provide cement from same source and of same type as concrete to be finished or repaired.
 - 5. In accordance with NSF 61.

- K. Sheet membrane for curing:
 - 1. Polyethylene film:
 - a. In accordance with ASTM C 171.
 - b. Color: White.
 - c. Thickness: Nominal thickness of polyethylene film shall not be less than 0.0040 inches when measured in accordance with ASTM D 2103. Thickness of polyethylene film at any point shall not be less than 0.0030 inches.
 - d. Loss of moisture: Not exceed 0.055 grams per square centimeter of surface when tested in accordance with ASTM C 156.
- L. Sprayed membrane curing compound: Clear type with fugitive dye in accordance with ASTM C 309, Type 1D.
- M. Surface sealant system: Manufacturers: One of the following or equal:
 - 1. Radcon Laboratories, Inc., Las Vegas, Nevada, Formula Number 7.
 - 2. IPA Systems, Philadelphia, Pennsylvania, Duripal.
- N. Water:
 - 1. Water for concrete, washing aggregate, and curing concrete: Clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances.
 - 2. Chlorides and sulfate ions:
 - a. Water for conventional reinforced concrete: Use water containing not more than 1,000 milligrams per liter of chlorides calculated as chloride ion, nor more than 1,000 milligrams per liter of sulfates calculated as sulfate ion.
 - b. Water for prestressed or post-tensioned concrete: Use water containing not more than 650 milligrams per liter of chlorides calculated as chloride ion, or more than 800 milligrams per liter of sulfates calculated as sulfate ion.

2.02 EQUIPMENT

- A. Mixing concrete:
 - 1. Mixers may be of stationary plant, paver, or truck mixer type.
 - 2. Provide adequate equipment and facilities for accurate measurement and control of materials and for readily changing proportions of material.
 - 3. Mixing equipment:
 - a. Capable of combining aggregates, cementitious materials, and water within specified time into thoroughly mixed and uniform mass and discharging mixture without segregation.
 - b. Maintain concrete mixing plant and equipment in good working order and operated at loads, speeds, and timing recommended by manufacturer or as specified.
 - c. Proportion cementitious materials and aggregate by weight.
- B. Machine mixing:
 - 1. Batch plant shall be capable of controlling delivery of all material to mixer within 1 percent by weight of individual material.

2. If bulk cementitious materials are used, weigh them on separate visible scale which will accurately register scale load at any stage of weighing operation from zero to full capacity.
 3. Prevent cementitious materials from coming into contact with aggregate or with water until materials are in mixer ready for complete mixing with all mixing water.
 4. Procedure of mixing cementitious materials with sand or with sand and coarse aggregate for delivery to project site, for final mixing and addition of mixing water will not be permitted.
 5. Retempering of concrete will not be permitted.
 6. Discharge entire batch before recharging.
 7. Volume of mixed material per batch: Not exceed manufacturer's rated capacity of mixer.
 8. Mixers:
 - a. Perform mixing in batch mixers of acceptable type.
 - b. Equip each mixer with device for accurately measuring and indicating quantity of water entering concrete, and operating mechanism such that leakage will not occur when valves are closed.
 - c. Equip each mixer with device for automatically measuring, indicating, and controlling time required for mixing:
 - 1) Interlock device to prevent discharge of concrete from mixer before expiration of mixing period.
- C. Transit-mixed concrete:
1. Mix and deliver in accordance with ASTM C 94.
 2. Total elapsed time between addition of water at batch plant and discharging completed mix:
 - a. Not to exceed 90 minutes.
 - b. Elapsed time at project site shall not exceed 30 minutes.
 3. Under conditions contributing to quick setting, total elapsed time permitted may be reduced by the Engineer.
 4. Equip each truck mixer with device interlocked to prevent discharge of concrete from drum before required number of turns and furnish device that is capable of counting number of revolutions of drum.
 5. Continuously revolve drum after it is once started until it has completely discharged its batch:
 - a. Do not add water until drum has started revolving.
 - b. Right is reserved to increase required minimum number of revolutions or to decrease designated maximum number of revolutions allowed, if necessary, to obtain satisfactory mixing. The Contractor will not be entitled to additional compensation because of such increase or decrease.
- D. Other types of mixers: In case of other types of mixers, mixing shall be as follows:
1. Mix concrete until there is uniform distribution of materials, and discharge mixer completely before recharging.
 2. Neither speed nor volume loading of mixer shall exceed manufacturer's recommendations.
 3. Continue mixing for minimum of 1-1/2 minutes after all materials are in drum, and for batches larger than 1 cubic yard increase minimum mixing time 15 seconds for each additional cubic yard or fraction thereof.

2.03 MIXES

- A. Measurements of materials:
 - 1. Measure materials by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the Engineer.
 - 2. Furnish apparatus for weighing aggregates and cementitious materials that is suitably designed and constructed for this purpose.
 - 3. Accuracy of weighing devices: Furnish devices that have capability of providing successive quantities of individual material that can be measured to within 1 percent of desired amount of that material.
 - 4. Measuring or weighing devices: Subject to review by the Engineer. Shall bear valid seal of the Sealer of Weights and Measures having jurisdiction.
 - 5. Weighing cementitious materials:
 - a. Weigh cementitious materials separately.
 - b. Cement in unbroken standard packages (sacks): Need not be weighed.
 - c. Weigh bulk cementitious materials and fractional packages.
 - 6. Measure mixing water by volume or by weight.

- B. Concrete proportions and consistency:
 - 1. Provide concrete that can be worked readily into corners and angles of forms and around reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on surface.
 - 2. Prevent unnecessary or haphazard changes in consistency of concrete.
 - 3. Ratio of coarse aggregate to fine aggregate: Not less than 1.0 or more than 2.0 for all concrete Classes, with exception of Class CE.
 - 4. Aggregate:
 - a. Obtain aggregate from source that is capable of providing uniform quality, moisture content, and grading during any single day's operation.
 - 5. Maximum concrete mix water to cementitious materials ratio, minimum cementitious materials content, and slump range: Conform to values specified in Table A in this Section.
 - 6. Concrete batch weights: Control and adjust to secure maximum yield. At all times, maintain proportions of concrete mix within specified limits.
 - 7. Mix modification: If required, by the Engineer, modify mixture within limits set forth in this Section.

- C. Concrete mixes:
 - 1. Proportioning of concrete mix: Proportion mixes based on required compressive strength f'_{cr} .
 - 2. Mixes:
 - a. Adjusting of water: After acceptance, do not change mixes without acceptance by Engineer, except that at all times adjust batching of water to compensate for free moisture content of fine aggregate.
 - b. Total water content of each concrete class: Not exceed those specified in Table A in this Section.
 - c. Checking moisture content of fine aggregate: Furnish satisfactory means at batching plant for checking moisture content of fine aggregate.
 - 3. Change in mixes: Submit new mix design and perform new trial batch and test program as specified in this Section.

D. Classes of concrete:

1. Provide concrete consisting of 5 classes: Classes A, B, C, D, and CE. Use where specified or indicated on the Drawings.
2. Weight of concrete classes: Provide classes of concrete having minimum weight of 140 pounds per cubic foot.
3. Class B concrete: Class B concrete may be substituted for Class A concrete, when high-early strength concrete is needed in areas specifically accepted by the Engineer and that do not require sulfate resistant concrete.
4. Class C concrete: Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the Drawings.
5. Class D concrete: Use Class D for precast concrete items.
6. Class CE concrete: Use Class CE for electrical conduit encasements.
7. All other concrete, unless specified or otherwise indicated on the Drawings: Use Class A concrete.

TABLE A CONCRETE WITH AIR ENTRAINMENT				
Class	Specified Compressive Strength f'_c at 28 Days (Pounds per Square Inch)	Water-to-Cementitious Materials Ratio	Cementitious Materials per Cubic Yard of Concrete by Weight (Pounds)	Slump Range (Inches)
A	4,000	0.40 to 0.45	564 to 658	2 to 4
B (Type III cement)	4,000	0.40 to 0.45	564 to 658	2 to 4
C	2,500	Maximum 0.62	Minimum 423	3 to 6
D	4,500	0.40 to 0.45	564 to 658	2 to 4
CE	2,500	Maximum 0.62	Minimum 423	3 to 6

8. Pumped concrete: Provide pumped concrete that complies with all requirements of this Section.
9. Do not place concrete with slump outside limits indicated in Table A.
10. Classes:
 - a. Classes A, C, D, and CE concrete: Make with Type II low alkali portland cement.
 - b. Class B concrete: Make with Type III low alkali portland cement.
 - c. Admixtures: Provide admixtures as specified in this Section.

E. Air entraining admixture:

1. Add agent to batch in portion of mixing water.
2. Batch solution by means of mechanical batcher capable of accurate measurement.

2.04 SOURCE QUALITY CONTROL

A. Tests:

1. Trial batches:
 - a. After concrete mix designs have been accepted by Engineer, have trial batches of the accepted Class A, Class B, and Class D concrete mix designs prepared by testing laboratory acceptable to the Engineer.
 - b. Prepare trial batches using cementitious materials and aggregates proposed to be used for the Work.
 - c. Prepare trial batches with sufficient quantity to determine slump, workability, consistency, and finishing characteristics, and to provide sufficient test cylinders.
 - d. Test cylinders: Provide cylinders having 6-inch diameter by 12-inch length and that are prepared in accordance with ASTM C 31 for tests specified in this Section.
 - e. Determine slump in accordance with ASTM C 143.
 - f. Test cylinders from trial batch:
 - 1) Test 8 cylinders for compressive strength in accordance with ASTM C 39:
 - a) Test 4 cylinders at 7 days and 4 at 28 days.
 - b) Establish ratio between 7 day and 28 day strength for mix. 7-day strength may be taken as satisfactory indication of 28-day strength provided effects on concrete of temperature and humidity between 7 day and 28 day are taken into account.
 - 2) Average compressive strength of 4 test cylinders tested at 28 days: Equal to or greater than required average compressive strength (f'_{cr}) on which concrete mix design is based.
 - g. Drying Shrinkage:
 - 1) Prepare 5 drying shrinkage specimens in accordance with ASTM C 157, except as modified herein.
 - 2) Remove drying shrinkage specimens from molds at age of 23 hours plus or minus 1 hour after trial batching, then immediately place them in water at 73 degrees Fahrenheit plus or minus 3 degrees for at least 30 minutes and then measure specimens within 30 minutes thereafter to determine original length. Then submerge specimens in saturated limewater at 73 degrees Fahrenheit plus or minus 3 degrees for moist curing.
 - 3) Make measurement to determine expansion expressed as percentage of original length at age 7 days. Use length at age 7 days as base length for drying shrinkage calculations.
 - 4) Immediately store specimens in humidity controlled room maintained at 73 degrees Fahrenheit plus or minus 3 degrees and 50 percent plus or minus 4 relative humidity for remainder of test.
 - 5) Make and report measurements to determine shrinkage expressed as percentage of base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
 - 6) Drying Shrinkage Deformation:
 - a) Measure drying shrinkage deformation of each specimen as difference between base length and length after drying at each test age.
 - b) Measure average drying shrinkage deformation of specimens to nearest 0.0001 inch at each test age.

- c) If drying shrinkage of any specimen departs from average of test age by more than 0.0004 inch, disregard results obtained from that specimen and test another specimen.
 - d) Shrinkage of trial batch concrete at 28 days drying age shall not exceed 0.045 percent maximum.
 - h. If trial batch tests do not meet specified requirements for slump, strength, workability, consistency, drying shrinkage, and finishing, change concrete mix design proportions and, if necessary, source of aggregate.
 - 1) Perform additional trial batches and tests until an acceptable trial batch is produced that meets requirements of this Section.
 - i. Perform test batches and tests required to establish trial batches and acceptability of materials without change in Contract Price.
 - j. Do not place concrete until the concrete mix design and trial batch have been accepted by Engineer.
2. Required average compressive strength:
- a. Determine required average compressive strength (f'_{cr}) for selection of concrete proportions for mix design, for each class of concrete, using calculated standard deviation for its corresponding specified compressive strength (f'_c) in accordance with ACI 318 and ACI 350.
 - b. When test records of at least 30 consecutive tests that span period of not less than 45 calendar days are available, establish standard deviation as in accordance with ACI 318 and ACI 350 and as modified in this Section.
 - c. Provide test records from which to calculate standard deviation that represent materials, quality control procedures, and conditions similar to materials, quality control procedures, and conditions expected to apply in preparation of concrete for the Work.
 - d. Provide test records with materials and proportions that are more restricted than those for the Work.
 - e. Specified compressive strength (f'_c) of concrete used in test records: Within 1,000 pounds per square inch of that specified for the Work.
 - f. When lacking adequate test records for calculation of standard deviation meeting requirements, determine required average compressive strength f'_{cr} from following Table B.

TABLE B	
REQUIRED AVERAGE COMPRESSION STRENGTH	
Specified Compressive Strength f'_c (pounds per square inch)	Required Average Compressive Strength f'_{cr} (pounds per square inch)
Less than 3,000	$f'_c + 1,000$
3,000 to 5,000	$f'_c + 1,200$
Over 5,000	$1.10f'_c + 700$

3. Aggregate:
- a. Testing of concrete aggregate is at Contractor's expense.
 - b. If there is change in aggregate source or if there is a significant change in aggregate quality or sieve analysis from same source, submit new set of design mixes covering each class of concrete and prepare new trial batches before further placing of concrete.
 - c. Sieves: Use sieves with square openings for testing grading of aggregates.
 - d. Sample aggregate in accordance with ASTM C 136 and D 75.

- e. Fine aggregate:
 - 1) Provide fine aggregate that does not contain strong alkali nor organic matter which gives color darker than standard color when tested in accordance with ASTM C 40.
 - 2) Provide aggregate having soundness in accordance with ASTM C 33 when tested in accordance with ASTM C 88.
 - 3) Provide aggregate complying with reactivity requirements in accordance with ASTM C 33 when tested in accordance with ASTM C 289.
- f. Coarse aggregate:
 - 1) Soundness when tested in accordance with ASTM C 88: Have loss not greater than 10 percent when tested with sodium sulfate.
 - 2) Abrasion Loss: Not exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131.
 - 3) Reactivity: Not exceed limits specified in Appendix of ASTM C 33 when tested in accordance with ASTM C 289.
 - 4) Fly ash:
 - a) Sampling and testing: Sample and test fly ash in accordance with ASTM C 311.
 - 5) Portland cement:
 - a) Determination of alkali content: In accordance with ASTM C 114.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Liquid evaporation retardant:
 - 1. Under conditions that result in rapid evaporation of moisture from the surface of the concrete, immediately after the concrete has been screeded, coat the surface of the concrete with a liquid evaporation retardant.
 - 2. Apply the evaporation retardant again after each work operation as necessary to prevent drying shrinkage cracks.
 - 3. Conditions which result in rapid evaporation of moisture may include one or more of the following:
 - a. Low humidity.
 - b. Windy conditions.
 - c. High temperature.
- B. Surface sealant system:
 - 1. Apply as recommended by manufacturer published instructions.
 - 2. Where concrete continues to sweat or leak, apply additional coats of surface sealant until the sweating or leaks stop.
- C. Joints and bonding:
 - 1. As far as practicable construct concrete work as monolith.
 - 2. Locations of construction, expansion, and other joints are indicated on the Drawings or as specified in this Section.
 - 3. Time between placement of adjacent concrete separated by joints:
 - a. Provide not less than 3 days (72 hours) between placement of adjacent sections for the following:

- 1) Slabs.
 - 2) Walls.
 - b. Provide not less than 7 days (168 hours) between placement of upper and lower pours for the following:
 - 1) Walls over slabs.
 - 2) Slabs over walls.
 - 3) Slabs keyed into the sides of walls.
 4. Construction joints:
 - a. Where construction joints are not indicated on the Drawings, provide construction joints in slabs and walls at intervals not greater than 35 feet.
 - b. In order to preserve strength and watertightness of structures, make no other joints, except as authorized the Engineer.
 - c. At construction joints, thoroughly clean concrete of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of heavy sandblasting.
 - d. Cleaning of construction joints:
 - 1) Wash construction joints free of sawdust, chips, and other debris after forms are built and immediately before concrete or grout placement.
 - 2) Should formwork confine sawdust, chips, or other loose matter in such manner that it is impossible to remove them by flushing with water, use vacuum cleaner for their removal, after which flush cleaned surfaces with water.
 - 3) Provide cleanout hole at base of each wall and column for inspection and cleaning.
 - e. At horizontal joints: As initial placement over cold joints, thoroughly spread bed of cement grout as specified in Section 03600 (with a thickness of not less than 1/2 inch nor more than 1 inch).
 5. Take special care to ensure that concrete is well consolidated around and against waterstops and waterstops are secured in proper position.
 6. Construction and expansion Joints:
 - a. Constructed where and as indicated on the Drawings.
 - b. Waterstops, expansion joint material, synthetic rubber sealing compound, and other similar materials: As specified in Sections 03150 and 07900.
 7. Repair of concrete: Where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, first coat surface of set concrete with epoxy bonding agent as specified in Section 03071.
- D. Conveying and placing concrete:
1. Convey concrete from mixer to place of final deposit by methods that prevent separation or loss of materials.
 2. Use equipment for chuting, pumping, and conveying concrete of such size and design as to ensure practically continuous flow of concrete at delivery end without segregation of materials.
 3. Design and use chutes and devices for conveying and depositing concrete that direct concrete vertically downward when discharged from chute or conveying device.
 4. Keep equipment for conveying concrete thoroughly clean by washing and scraping upon completion of day's placement.
- E. Placing concrete:
1. Place no concrete without prior authorization of the Engineer.

2. Do not place concrete until:
 - a. Reinforcement is secure and properly fastened in its correct position and loose form ties at construction joints have been retightened.
 - b. Dowels, bucks, sleeves, hangers, pipes, conduits, anchor bolts, and any other fixtures required to be embedded in concrete have been placed and adequately anchored.
 - c. Forms have been cleaned and oiled as specified.
3. Do not place concrete in which initial set has occurred, or that has been retempered.
4. Do not place concrete during rainstorms or high velocity winds.
5. Protect concrete placed immediately before rain to prevent water from coming in contact with such concrete or winds causing excessive drying.
6. Keep sufficient protective covering on hand at all times for protection of concrete.
7. After acceptance, adhere to proposed sequence of placing concrete, except when specific changes are requested and accepted by the Engineer.
8. Notify the Engineer in writing of readiness, not just intention, to place concrete in any portion of the work:
 - a. Provide this notification in such time in advance of operations, as the Engineer deems necessary to make final inspection of preparations at location of proposed concrete placing.
 - b. Place forms, reinforcement, screeds, anchors, ties, and inserts in place before notification of readiness is given to the Engineer.
 - c. Depositing concrete:
 - 1) Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing.
 - 2) Do not deposit concrete in large quantities in one place and work along forms with vibrator or by other methods.
 - 3) Do not drop concrete freely into place from height greater than 5 feet.
 - 4) Use tremies for placing concrete where drop is over 5 feet.
 - 5) Commence placement of concrete on slopes, starting at bottom of slope.
9. Place concrete in approximately horizontal layers not to exceed 24 inches in depth and bring up evenly in all parts of forms.
10. Continue concrete placement without avoidable interruption, in continuous operation, until end of placement is reached.
11. After concrete placement begins, continue concrete placement without significant interruption. Plan and implement precautions to prevent any delay, between layers being placed, from exceeding 20 minutes.
12. If concrete is to be placed over previously placed concrete and more than 20 minutes has elapsed, spread layer of cement grout not less than 1/2 inch in thickness nor more than 1 inch in thickness over surface before placing additional concrete.
13. Placement of concrete for slabs, beams, or walkways:
 - a. If cast monolithically with walls or columns, do not commence until concrete in walls or columns has been allowed to set and shrink.
 - b. Allow set time of not less than 1 hour for shrinkage.

F. Consolidating concrete:

1. Place concrete with aid of acceptable mechanical vibrators.
2. Thoroughly consolidate concrete around reinforcement, pipes, or other shapes built into the work.

3. Provide sufficiently intense vibration to cause concrete to flow and settle readily into place and to visibly affect concrete over radius of at least 18 inches.
 4. Vibrators:
 - a. Keep sufficient vibrators on hand at all times to vibrate concrete as placed.
 - b. In addition to vibrators in actual use while concrete is being placed, have on hand minimum 1 spare vibrator in serviceable condition.
 - c. Do not place concrete until it has been ascertained that all vibrating equipment, including spares, are in serviceable condition.
 5. Take special care to place concrete solidly against forms to leave no voids.
 6. Take every precaution to make concrete solid, compact, and smooth. If for any reason surfaces or interiors have voids or are in any way defective, repair such concrete in manner acceptable to the Engineer.
- G. Footings and slabs on grade:
1. Do not place concrete on ground or compacted fill until subgrade is in moist condition acceptable to the Engineer.
 2. If necessary, sprinkle subgrade with water not less than 6 or more than 20 hours in advance of placing concrete.
 3. If subgrade becomes dry prior to concrete placement, sprinkle again, without forming pools of water.
 4. Do not place concrete if subgrade is muddy or soft.
- H. Loading concrete:
1. Green concrete:
 - a. No heavy loading of green concrete will be permitted.
 2. No backfill shall be placed against concrete walls, connecting slabs, or beams until the concrete has reached the specified strength.
 3. Use construction methods, sequencing, and allow time for concrete to reach adequate strength to prevent overstress of the concrete structure during construction.
- I. Curing concrete:
1. General:
 - a. Cure concrete by methods specified in this Section.
 - b. Keep concrete continuously moist and at a temperature of at least 50 degrees Fahrenheit for minimum of 7 days after placement.
 - c. Cure concrete to be painted with water or sheet membrane.
 - d. Do not use sprayed membrane curing or sealing compounds on concrete surfaces that are to receive paint or upon which any material is to be bonded.
 - e. Water cure or sheet membrane cure concrete slabs that are specified to be sealed by concrete sealer.
 - f. Cure other concrete by water curing or sprayed membrane curing compound at the Contractor's option.
 - g. Floor slabs may be cured using sheet membrane curing.
 2. Water curing:
 - a. Keep surfaces of concrete being water cured constantly and visibly moist day and night for period of not less than 7 days.
 - b. Each day forms remain in place count as 1 day of water curing.

- c. No further curing credit will be allowed for forms in place after contact has once been broken between concrete surface and forms.
 - d. Do not loosen form ties during period when concrete is being cured by leaving forms in place.
 - e. Flood top of walls with water at least 3 times per day, and keep concrete surfaces moist at all times during 7 day curing period.
3. Sprayed membrane curing compound:
- a. Apply curing compound to concrete surface after repairing and patching, and within 1 hour after forms are removed.
 - b. If more than 1 hour elapses after removal of forms, do not use curing compound, but use water curing for full curing period.
 - c. If surface requires repairing or painting, water cure such concrete surfaces.
 - d. Do not remove curing compound from concrete in less than 7 days.
 - e. Curing compound may be removed only upon written request by Contractor and acceptance by Engineer, stating what measures are to be performed to adequately cure concrete.
 - f. Take care to apply curing compound to construction joints. Apply to all surfaces along full profile of joints.
 - g. After curing period is complete, remove curing compound placed within construction joint profile by heavy sandblasting prior to placing any new concrete.
 - h. Contractor's Option: Instead of using curing compound for curing of construction joints, such joints may be water cured.
 - i. Apply curing compound by mechanical, power operated sprayer and mechanical agitator that will uniformly mix all pigment and compound.
 - j. Apply curing compound in at least 2 coats.
 - k. Apply each coat in direction 90 degrees to preceding coat.
 - l. Apply curing compound in sufficient quantity so that concrete has uniform appearance and that natural color is effectively and completely concealed at time of spraying.
 - m. Continue to coat and recoat surfaces until specified coverage is achieved and until coating film remains on concrete surfaces.
 - n. Thickness and coverage of curing compound: Provide curing compound having film thickness that can be scraped from surfaces at any and all points after drying for at least 24 hours.
 - o. The Contractor is cautioned that method of applying curing compound specified in this Section may require more curing compound than normally suggested by manufacturer of curing compound and also more than is customary in the trade.
 - p. Apply amounts specified in this Section, regardless of manufacturer's recommendations or customary practice.
 - q. If the Contractor desires to use curing compound other than specified curing compound, coat sample areas of concrete wall with proposed curing compound and also similar adjacent area with specified compound in specified manner for comparison:
 - 1) If proposed sample is not equal or better, in opinion of the Engineer, in all features, proposed substitution will not be allowed.
 - r. Prior to final acceptance of the work, remove, by sandblasting or other acceptable method, any curing compound on surfaces exposed to view, so that only natural color of finished concrete is visible uniformly over entire surface.

4. Sheet membrane curing:
 - a. Install sheet membrane as soon as concrete is finished and can be walked on without damage.
 - b. Seal joints and edges with small sand berm.
 - c. Keep concrete moist under sheet membrane.

- J. Cold weather concreting:
 1. Preparation before concreting:
 - a. Remove snow, ice, and frost from the surfaces, including reinforcement against which the concrete is to be placed.
 - b. The subgrade shall be free of frost before concrete placing begins.
 - c. Do not place concrete around any embedment that is at a temperature below freezing and is sufficiently massive as to cause the adjacent concrete to freeze.
 2. Placement of concrete:
 - a. Placement temperature:
 - 1) The minimum temperature of concrete immediately after placement shall be as specified in Table C.
 - 2) The temperature of concrete as placed shall not exceed the values shown in Table C by more than 20 degrees Fahrenheit.
 - b. Protection temperature:
 - 1) Unless otherwise specified, the minimum temperature of concrete during the protection period shall be as shown Table C.
 - 2) Temperatures specified to be maintained during the protection period shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air.
 - 3) Measure the temperature with a surface measuring device accurate to 2 degrees Fahrenheit.
 - 4) Measure the temperature of concrete in each placement at regular time intervals as specified in the contract documents.
 - c. Termination of protection:
 - 1) The maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the values listed in Table C.
 - 2) Do not exceed these limits until the surface temperature of the concrete is within 20 degrees Fahrenheit of the ambient temperature of surrounding temperatures.
 - 3) When the surface temperature of the concrete is within 20 degrees Fahrenheit of the ambient temperature, all protection may be removed.

**Table C
CONCRETE TEMPERATURE REQUIREMENTS**

Least dimension of section (inches)	Minimum temperature of concrete as placed and maintained during the protection period (degrees Fahrenheit)	Maximum for gradual decrease in surface temperature during any 24 hour period after end of protection period (degrees Fahrenheit)
Less than 12	55	50
12 to less than 36	50	40
36 to 72	45	30
Greater than 72	40	20

3. Curing of concrete:
 - a. Prevent concrete from drying during the required curing period. If water curing is used, terminate use at least 24 hours before any anticipated exposure of the concrete to freezing temperatures.
4. Protection of concrete:
 - a. Combustion heaters: Vent flue gases from combustion heating units to the outside of the enclosures.
 - b. Overheating and drying: Place and direct heaters and ducts to avoid areas of overheating or drying of the concrete surface.
 - c. Maximum air temperature: During the protection period, do not expose the concrete surface to air having a temperature more than 20 degrees Fahrenheit above the values shown in Table C unless higher values are required by an accepted curing method.
 - d. Protection against freezing:
 - 1) Cure and protect concrete against damage from freezing for a minimum of 3 days, unless otherwise specified.
 - a) Maintain the surface temperature of the concrete as specified in Table C.
 - 2) During periods not defined as cold weather, but when freezing temperatures may occur, protect concrete surfaces against freezing for the first 24 hours after placing.

3.02 CONCRETE FINISHING

- A. Provide concrete finishes as specified in Section 03366.
- B. Edges of joints:
 1. Provide joints having edges as indicated on the Drawings.
 2. Protect wall and slab surfaces at edges against concrete spatter and thoroughly clean upon completion of each placement.
- C. Concrete sealer:
 1. Floors and slabs to receive concrete sealer: As specified in the Contract Documents on finish schedule.
 2. Apply concrete sealer:
 - a. Apply concrete sealer at coverage rate not to exceed 300 square feet per gallon.
 - b. Apply as soon as slab or floor will bear weight.

- c. Sealer:
 - 1) Before applying concrete sealer, sweep entire surface clean with very soft bristled brush that will not mark concrete finish and remove any standing water.
 - 2) Apply concrete sealer with sprayer.
 - 3) Use of paint rollers or mop is not acceptable.
 - 4) Workmen shall wear flat soled shoes which will not mark or scar concrete surface.
 - 5) Do not allow traffic on floors and slabs until concrete sealer has dried and hardened.

3.03 FIELD QUALITY CONTROL

- A. Testing of concrete:
 - 1. During progress of construction, the Owner will have tests made to determine whether the concrete, as being produced, complies with requirements specified.
 - 2. Tests will be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 172.
 - 3. The Contractor will coordinate with the Testing Lab and will make and deliver test cylinders to the laboratory. All testing expenses will be borne by the Contractor.
 - 4. Furnish test equipment.
 - 5. Make provisions for and furnish concrete for test specimens, and provide manual assistance to the Engineer in preparing said specimens.
 - 6. Assume responsibility for care of and providing of curing conditions for test specimens in accordance with ASTM C 31.
 - 7. Sampling frequency:
 - a. 1 set of test cylinders for each 150 cubic yards of each class of concrete.
 - b. Minimum of 1 set of test cylinders for each class of concrete placed.
 - c. Not less than 1 set of test cylinders for each half-day's placement.
 - d. At least 2 sets of test cylinders for each structure.
- B. Compressive strength tests:
 - 1. Set of 3 cylinder specimens, 6-inch diameter by 12 inch long.
 - 2. Information: Test 1 cylinder at 7 days.
 - 3. Acceptance: Test 2 cylinders at 28 days.
- C. Slump tests:
 - 1. Test slump of concrete using slump cone in accordance with ASTM C 143.
 - 2. Do not use concrete that does not meet specification requirements in regards to slump:
 - a. Remove such concrete from project site.
 - b. Test slump at the beginning of each placement, as often as necessary to keep slump within the specified range, and when requested to do so by the Engineer.
- D. Air entrainment tests:
 - 1. Test percent of entrained air in concrete at beginning of each placement, as often as necessary to keep entrained air within specified range, and when requested to do so by the Engineer.

2. Do not use concrete that does not meet Specification requirements for air entrainment.
 - a. Remove such concrete from project site.
 3. Test air entrainment in concrete in accordance with ASTM C 173.
 4. The Engineer may at any time test percent of entrained air in concrete received on project site.
- E. Enforcement of strength requirement:
1. Concrete is expected to reach a compressive strength (f'_c) than that specified in Table A.
 2. Strength level of concrete will be considered acceptable if following conditions are satisfied:
 - a. Averages of all sets of 3 consecutive strength test results is greater or equal to specified compressive strength(f'_c).
 - b. No individual strength test (average of 2 cylinders) falls below specified compressive strength (f'_c) by more than 500 pounds per square inch.
 3. Non-compliant strength tests:
 - a. Mark non-compliant strength test reports to highlight that they contain non-complying results and immediately forward copies of test reports to all parties on the test report distribution list.
 - b. Provide treatment of non-compliant concrete at no additional cost to Owner and with no additional time added to project schedule:
 - c. Initial treatment may consist of additional curing and testing of the affected concrete.
 - 1) Provide additional curing of concrete using means and duration acceptable to the Engineer.
 - 2) Upon completion of the additional curing, provide additional testing designated by the Engineer.
 - a) Obtain and test core samples for compression strength in accordance with ASTM C 42, ACI 318, and ACI 350.
 - b) Provide not less than 3 cores for each affected area. Obtain Engineer's acceptance of proposed coring locations before proceeding with that work.
 - c) Submit report of compression strength testing for Engineer's review.
 - d) If required by the Engineer, provide additional cores and obtain petrographic examination in accordance with ASTM C 856. Submit report of petrographic analysis for Engineer's review.
 - 3) If additional curing does not bring average of 3 cores taken in affected area to at least the minimum specified compressive strength (f'_c), designate such concrete in affected area as defective.

3.04 ADJUSTING

- A. Provide repair of defective concrete at no additional cost to Owner and with no additional time added to the project schedule:
- B. Make repairs using approach and means acceptable to the Engineer.
 1. Provide repairs having strength equal to or greater than specified concrete for areas involved.
 2. Do not patch, repair, or cover defective work without inspection by the Engineer.

3. Acceptable means may include, but are not limited to strengthening, repair, or removal and replacement.
- C. Strengthening of defective concrete.
1. By addition of concrete.
 2. By addition of reinforcing.
 3. By addition of both concrete and reinforcing.
- D. Repairs.
1. Methods of repair:
 - a. Dry pack method:
 - 1) Use for holes having depth nearly equal to or greater than least surface dimension of hole, for cone-bolt holes, and for narrow slots cut for repair.
 - 2) Smooth holes: Clean and roughen by heavy sandblasting before repair.
 - b. Mortar replacement method:
 - 1) Use for holes too wide to dry pack and too shallow for concrete replacement.
 - 2) Comparatively shallow depressions, large or small, which extend no deeper than nearest surface reinforcement.
 - c. Concrete replacement method:
 - 1) Use when holes extend entirely through concrete section or when holes are more than 1 square foot in area and extend halfway or more through the section.
 2. Preparation of concrete for repair:
 - a. Chip out and key imperfections in the work and make them ready for repair.
 - b. Obtain Engineer's acceptance of surface preparation methods and of prepared surfaces prior to repair.
 - c. Surfaces of set concrete to be repaired: First coat with epoxy bonding agent as specified in Section 03071.
- E. Removal and replacement of defective concrete.

END OF SECTION

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SECTION 03366

TOOLED CONCRETE FINISHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Tooled concrete finishes. Coordinate with all other finishing requirements shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Mock-ups:
 - 1. Test panels for concrete finishes:
 - a. Prepare test panels for F4 and F5 finishes and tie-hole repairs for review by Engineer and Owner's Representative (Plant Superintendent).
 - b. Accepted test panels serve as standard of quality and workmanship for project.
 - 2. Prepare test panel showing horizontal and vertical joints proposed for project for review by the Engineer. Refer to finishes specified in this Section.
 - 3. Test panels indicating methods for making concrete repairs: Prepare test panels for proposed repairs at beginning of project for review by Engineer:
 - a. Accepted test panels serve as standard for repairs during the project.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping:
 - 1. Deliver and store packaged materials in original containers until ready for use.

PART 2 PRODUCTS

2.01 MIXES

- A. Mortar mix for F4 finish: Consist of 1 part cement and 1-1/2 parts of fine sand passing Number 100 screen. Mix with enough water and emulsified bonding agent to have consistency of thick cream.
- B. Mortar mix for F5 finish: Consist of 1 part cement to 1-1/2 parts of sand which passes Number 16 screen.

PART 3 EXECUTION

3.01 CONCRETE FINISHES

- A. Cement for finishes:
 - 1. Addition of white cement may be required to produce finish which matches color of concrete to be finished.

- B. Finish vertical concrete surfaces with one of the following finishes as indicated in the Finish Schedule:
1. F1 finish: No special treatment other than repair defective work and fill depressions 1 inch or deeper and tie holes with mortar after removal of curing compound.
 2. F2 finish: No special treatment other than repair defective work, remove fins, fill depressions 1/2 inch or deeper and tie holes with mortar after removal of curing compound.
 3. F3 finish: Repair defective work, remove fins, offsets, and grind projections smooth. Fill depressions 1/4 inch or larger in depth or width and tie holes with mortar after removal of curing compound.
 4. F4 finish: Receive same finish as specified for F3 finish, and, in addition fill depressions and holes 1/16 inch or larger in width with mortar.
 - a. "Brush-Off" sandblast surfaces prior to filling holes to expose all holes near surface of the concrete.
 - b. Thoroughly wet surfaces and commence filling of pits, holes, and depressions while surfaces are still damp.
 - c. Perform filling by rubbing mortar over entire area with clean burlap, sponge rubber floats, or trowels.
 - d. Do not let any material remain on surfaces, except that within pits and depressions.
 - e. Wipe surfaces clean and moist cure.
 5. F5 finish: Receive same finish as specified for F3 finish, and, in addition, receive special stoned finish, in accordance with following requirements:
 - a. Remove forms and perform required repairs, patching, and pointing as specified in this Section.
 - b. Wet surfaces thoroughly with brush and rub with hard wood float dipped in water containing 2 pounds of portland cement per gallon.
 - c. Rub surfaces until form marks and projections have been removed.
 - d. Spread grindings from rubbing operations uniformly over surface with brush in such manner as to fill pits and small voids.
 - e. Moist cure brushed surfaces and allow to harden for 3 days:
 - 1) After curing, obtain final finish by rubbing with carborundum stone of approximately Number 50 grit until entire surfaces have smooth texture and are uniform in color.
 - 2) Continue curing for remainder of specified time.
 - f. If any concrete surface is allowed to become too hard to finish in above specified manner, sandblast and wash related surfaces exposed to view, whether finished or not.
 - 1) While still damp, rub over surface, plastic mortar, as specified for brushed surfaces and handstoned with Number 60 grit carborundum stone, using additional mortar for brushed surfaces until surface is evenly filled without an excess of mortar.
 - 2) Continue stoning until surface is hard.
 - 3) After moist curing for 3 days, make surface smooth in texture and uniform in color by use of Number 50 or Number 60 grit carborundum stone.
 - 4) After stoning, continue curing until 7 day curing period is completed.
- C. Finish horizontal concrete surfaces with one of the following finishes as indicated in the Finish Schedule after proper and adequate vibration and tamping:
1. S1 finish: Screeded to grade and leave without special finish.

2. S2 finish: Smooth steel trowel finish.
 3. S3 finish: Steel trowel finish free from trowel marks. Provide smooth finish free of all irregularities.
 4. S4 finish: Steel trowel finish, without local depressions or high points, followed by light hairbroom finish. Do not use stiff bristle brooms or brushes. Perform brooming parallel to slab-drainage. Provide resulting finish that is rough enough to provide nonskid finish. Finish is subject to review and acceptance by the Engineer.
 5. S5 finish: Nonslip abrasive: After concrete has been screeded level and hardened enough to support man standing on a board, sprinkle abrasive from shake screen into surface at uniform rate of 25 pounds for each 100 square feet of surface area, wood float into finish, then trowel abrasive into surface with steel trowel properly exposing abrasive in surface as required to provide nonslip surface.
 6. S6 finish: Roughened finish: After concrete has been screeded to grade, apply a roughened finish by use of a jitterbug roller or similar device.
- D. Finish concrete floor surfaces to which surfacing material is applied: Finish smooth with tolerance within 1/8 inch in 10 feet in any direction from lines indicated on the Drawings.

3.02 CONCRETE FINISH SCHEDULE

- A. Finish concrete surfaces as follows:
1. F4 finish for following vertical surfaces:
 - a. Concrete surfaces specified or indicated to be painted.
 - b. Concrete surfaces, interior or exterior, exposed to view.
 2. Surfaces in open channels, basins, and similar structures:
 - a. F3 finish for vertical surfaces which are normally below water surface.
 - b. F4 finish for vertical surfaces located above normal water surface and exposed to view.
 - c. Remove fins and fill tie holes from concrete surfaces located in closed boxes or channels where there is normally no access or passageway.
 3. S1 finish for following surfaces:
 - a. Projecting footings which are to be covered with dirt.
 - b. Slab surfaces which are to be covered with concrete fill.
 4. S2 finish for following surfaces:
 - a. Tops of corbels.
 - b. Tops of walls and beams not covered above in this Section.
 - c. Tops of slabs not covered above in this Section.
 - d. All other surfaces not specified to be finished otherwise.
 5. S3 finish for following surfaces:
 - a. Building and machine room floors which are not covered with surfacing material: Provide floors that are free from trowel marks.
 6. S4 finish for following surfaces:
 - a. Exterior walkways.
 - b. Tops of exterior walls or beams which are to serve as walkways.
 - c. Tops of exterior walls or beams which are to support gratings.
 - d. Top surface of slabs for basins, channels, digesters, and similar structures.

7. S6 finish for following surfaces:
 - a. Basin bottoms, or other similar slab surfaces, over which layer of basin bottom grout will be applied.

END OF SECTION

SECTION 03600

GROUTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Cement grout.
 - 2. Cement mortar.
 - 3. Dry-pack mortar.
 - 4. Epoxy grout.
 - 5. Grout.
 - 6. Non-shrink epoxy grout.
 - 7. Non-shrink grout.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 03071 - Epoxies.
 - b. Section 03300 - Cast-In-Place Concrete.
 - c. Section 15050 - Basic Mechanical Materials and Methods.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or 50-millimeter cube specimens).
 - 2. C 230 - Standard Specification for Flow Table for Use In Tests of Hydraulic Cement.
 - 3. C 531 - Standard Test Method for Liner Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 4. C 579 - Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
 - 5. C 939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
 - 6. C 942 - Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
 - 7. C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
 - 8. C 1181 - Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

1.03 SUBMITTALS

- A. Cement grout:
 - 1. Mix design.
 - 2. Material submittals.
- B. Cement mortar:
 - 1. Mix design.
 - 2. Material submittals.
- C. Non-shrink grout: Submit manufacturer's literature.
- D. Non-shrink epoxy grout: Submit manufacturer's literature.
- E. Concrete grout: The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated herein. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the jobsite in their original, unopened packages or containers, clearly labeled with the manufacturer's product identification and printed instructions.
- B. Store materials in a cool dry place and in accordance with the manufacturer's recommendations.
- C. Handle materials in accordance with the manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Non-shrink epoxy grout:
 - 1. Manufacturers: One of the following or equal:
 - a. Five Star Products, Inc., Fairfield, CT, Five Star Epoxy Grout.
 - b. BASF Construction Chemicals, Shakopee, MN, Masterflow 648 CP Plus.
 - c. L&M Construction Chemicals, Inc., EPOGROUT.
 - 2. Non-shrink epoxy grout shall be a 100 percent solid, premeasured, prepackaged system containing a 2-component thermosetting epoxy resin and inert aggregate.
 - 3. Maintain a flowable consistency for at least 45 minutes at 70 degrees Fahrenheit.
 - 4. Shrinkage or expansion (less than 0.0006 inches/inch) when tested in accordance with ASTM C 531.
 - 5. Minimum compressive strength: 10,000 pounds per square inch at 24 hours and 14,000 pounds per square inch at 7 days when tested in accordance with ASTM C 579, Method B.
 - 6. Compressive creep: Not exceed 0.0027 inches/inch when tested under a 400 pounds per square inch constant load at 140 degrees Fahrenheit in accordance with ASTM C 1181.

7. Coefficient of thermal expansion: Not exceed 0.000018 inches per inch per degree Fahrenheit when tested in accordance with ASTM C 531, Method B.
- B. Non-shrink grout:
1. Manufacturers: One of the following or equal:
 - a. Five Star Products, Inc., Fairfield, CT, Five Star Grout.
 - b. BASF Construction Chemicals, Shakopee, MN, Masterflow 928.
 - c. L&M Construction Chemicals, Inc., Omaha, NE, CRYSTEX.
 2. In accordance with ASTM C 1107.
 3. Proportioned and prepackaged cement-based mixture:
 - a. It shall contain no metallic particles such as aluminum powder and no metallic aggregate such as iron filings.
 - b. It shall require only the addition of potable water.
 4. Water for pre-soaking, mixing, and curing: Potable water.
 5. Free from the emergence of mixing water from within or the presence of water on its surface.
 6. Remain at a minimum flowable consistency for at least 45 minutes after mixing at 45 degrees Fahrenheit to 90 degrees Fahrenheit when tested in accordance with ASTM C 230.
 - a. If at a fluid consistency, it shall be verified in accordance with ASTM C 939.
 7. Dimensional stability (height change):
 - a. In accordance with ASTM C 1107, volume-adjusting Grade B or C at 45 degrees Fahrenheit to 90 degrees Fahrenheit.
 - b. Have 90 percent or greater bearing area under bases.
 8. Have minimum compressive strengths at 45 degrees Fahrenheit to 90 degrees Fahrenheit in accordance with ASTM C 1107 for various periods from the time of placement, including 5,000 pounds per square inch at 28 days when tested in accordance with ASTM C 109 as modified by ASTM C 1107.

2.02 MIXES

- A. Cement grout:
1. Consist of concrete mix with coarse aggregate removed and water quantity adjusted as required.
 2. Use the same materials for cement grout that are used for concrete.
 3. Use water-to-cementitious materials ratio that is no more than that specified for concrete being repaired.
 4. For spreading over the surfaces of construction or cold joints. Mix with no more water used than allowed by water-to-cementitious materials ratio specified for concrete.
- B. Cement mortar:
1. Consist of concrete mix with coarse aggregate removed and water quantity adjusted as required.
 2. Use the same materials for cement mortar that are used for concrete.
 3. Use water-to-cementitious materials ratio that is no more than that specified for concrete being repaired.
 4. At exposed concrete surfaces not to be painted or submerged in water: Use sufficient white cement to make color of finished patch match that of surrounding concrete.

- C. Dry-pack mortar:
 - 1. Mix in proportions by weight of 1 part portland cement to 2 parts of concrete sand.
 - a. Portland cement: As specified in Section 03300.
 - b. Concrete sand: As specified in Section 03300.
 - 2. Use only enough water so that resulting mortar will crumble to touch after being formed into ball by hand.

- D. Epoxy grout:
 - 1. Consist of mixture of epoxy or epoxy gel and concrete sand.
 - a. Epoxy: As specified in Section 03071.
 - b. Epoxy gel: As specified in Section 03071.
 - c. Sand: Clean, bagged, graded, and kiln dried silica sand.
 - 2. Proportioning:
 - a. For horizontal work: Consist of mixture of 1 part epoxy with not more than 2 parts sand.
 - b. For vertical or overhead work: Consist of 1 part concrete epoxy gel with not more than 2 parts sand.

- E. Grout:
 - 1. Mix in proportions by weight of 1 part portland cement to 4 parts of concrete sand.
 - a. Portland cement: As specified in Section 03300.
 - b. Concrete sand: As specified in Section 03300.

- F. Non-shrink epoxy grout: Mix in accordance with manufacturer's installation instructions.

- G. Non-shrink grout: Mix in accordance with manufacturer's installation instructions such that resulting mix has flowable consistency and is suitable for placing by pouring.

- H. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be 1/2 in maximum. Slump should not exceed 5 in and should be as low as practical yet still retain sufficient workability.

- I. Synthetic reinforcing fibers shall be added to the concrete grout mix at the rate of 1.5 lbs 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.
 - 1. Synthetic reinforcing fiber for concrete shall be 100 percent polypropylene collated, fibrillated fibers as manufactured by Propex Concrete Systems Chattanooga, TN Propex 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.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations, and all loose material or foreign matter likely to reduce the bond or performance of grout or mortar.

3.02 PREPARATION

- A. Surface preparation:
 - 1. Remove grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond from concrete and bottoms of baseplates.
 - 2. Roughen concrete surfaces by heavy sandblasting, waterblasting, chipping, or other mechanical means.
 - a. Remove loose or broken concrete.
 - 3. Metal surfaces: Sandblast to a 2 to 3 mil peak-to-valley profile.

3.03 PLACEMENT

- A. General:
 - 1. Use mortar mixer with moving paddles for mixing grouts. For cement grouts, pre-wet the mixer and empty out excess water before beginning mixing.
- B. Cement grout:
 - 1. Exercise particular care in placing cement grout since it is required to furnish structural strength, impermeable water seal, or both.
 - 2. Do not use cement grout that has not been placed within 30 minutes after mixing.
- C. Epoxy grouts:
 - 1. Use where indicated on the Drawings.
 - 2. Wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grout.
- D. Non-shrink grout:
 - 1. Add non-shrink cement grout to a premeasured amount of water that does not exceed the manufacturer's maximum recommended water content.
 - 2. Mix in accordance with manufacturer's instructions to uniform consistency.
 - 3. May be drypacked, flowed, or pumped into place. Do not overwork grouts.
 - 4. Do not retemper grout by adding more water after stiffening.
- E. Non-shrink epoxy grout:
 - 1. Mix in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.
 - 2. Pour the hardener into the resin and mix for at least 1 minute and until mixture is uniform in color. Pour the epoxy into a mortar mixer wheelbarrow and add the aggregate. Mix until aggregate is uniformly wetted. Over mixing will cause air entrapment in the mix.
 - 3. Keep temperature of non-shrink epoxy grout from exceeding manufacturer's recommendations.

- F. Curing:
 - 1. Cement based grouts:
 - a. Non-shrink grout: Cure in accordance with manufacturer's recommendations. Keep grout wet for a minimum of 7 days. Use wet burlap, a soaker hose, sun shading, ponding, and in extreme conditions, a combination of methods.
 - b. Maintain grout above 40 degrees Fahrenheit until it has attained a compressive strength of 3,000 pounds per square inch, or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.
 - 2. Concrete Grout:
 - a. All concrete grout shall be water cured per specification 03300.
- G. Epoxy based grouts:
 - 1. Cure grouts in accordance with manufacturers' recommendations.
 - a. Do not wet cure epoxy grouts.
 - 2. Do not allow any surface in contact with epoxy grout to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.
- H. Grouting equipment bases and baseplates: As specified in Section 15050.
- I. Grouting other baseplates:
 - 1. General:
 - a. All baseplate grouting shall take place from one side of a baseplate to the other in a continuous flow to avoid trapping air.
 - b. Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to the maximum level and the grout worked down.
 - 2. Forms and headboxes:
 - a. Build forms for grouts of material with adequate strength to withstand the placement of grouts.
 - b. Forms shall be rigid and liquidtight. Caulk cracks and joints with an elastomeric sealant. Line forms with polyethylene for easy grout release. Forms carefully wax with 2 coats of heavy-duty paste wax will also be acceptable.
 - c. Forms shall be 4 to 6 inches higher than the baseplate on one side of the baseplate configuration when using head pressure for placement.
 - 3. Non-shrink epoxy grout:
 - a. Cut back epoxy grout after setting. Install epoxy grout with chamfer edges built into the formwork.

3.04 FIELD QUALITY CONTROL

- A. Non-shrink grout: Test for 24-hour compressive strength in accordance with ASTM C 942.
- B. Non-shrink epoxy grout: Test for 24-hour compressive strength in accordance with ASTM C 579, Method B.

END OF SECTION

SECTION 03931

EPOXY INJECTION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Epoxy injection system.

1.02 REFERENCES

- A. ASTM International (ASTM):
1. D 638 - Standard Test Method for Tensile Properties of Plastics.
 2. D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
 3. D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SUBMITTALS

- A. Product data:
1. Submit manufacturer's data completely describing epoxy injection system materials.
- B. Quality control submittals:
1. Certificates of Compliance.
 2. Manufacturer's Instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers: One of the following or equal:
1. BASF, Concessive Standard LVI.
 2. Sika Chemical Corp., Sikadur 35 Hi-Mod LV.
- B. Epoxy:
1. Use epoxy materials that are new and use them within shelf-life limitations set forth by manufacturer.
 2. Water-insensitive 2-part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified:

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch at 14 days.
Flexure Strength	ASTM D 790	11,000 pounds per square inch at 14 days.
Compressive Strength	ASTM D 695	11,000 pounds per square inch at 24 hours.
Bond Strength	--	Concrete shall fail before failure of epoxy.
Gel Time for 5 Mil Film	--	4 hours maximum.
Elongation	ASTM D 638	1 percent minimum at 14 days.

2.02 EQUIPMENT

- A. Injection pump:
 - 1. Use positive displacement injection pump with interlock to provide in-line mixing and metering system for 2 component epoxy.
 - 2. Use pressure hoses and injection nozzle designed to properly mix of 2 components of epoxy.
 - 3. Standby injection unit may be required.

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface preparation:
 - 1. Sweep or clean area in vicinity of cracks that will be injected with epoxy. Leave area in generally clean condition after epoxy injection is complete.
 - 2. Clean cracks so they are free from dirt, laitance, and other loose matter.

3.02 INSTALLATION

- A. Install and cure epoxy materials in accordance with manufacturer's installation instructions.
- B. Mix epoxy in accordance with manufacturer's installation instructions.
- C. Do not use solvents to thin epoxy.
- D. Crack injection:
 - 1. Apply adequate surface seal to crack to prevent leakage of epoxy.
 - 2. Establish injection points at distance along crack not less than thickness of cracked member.
 - 3. Crack injection sequence:
 - a. Inject epoxy into crack at first port with sufficient pressure to advance epoxy to adjacent port.
 - b. Seal original port and shift injection to port where epoxy appears.
 - c. Continue port-to-port injection until crack has been injected for its entire length.
 - d. For small amounts of epoxy, or where excessive pressure developed by injection pump might further damage structure, premixed epoxy and use hand caulking gun to inject epoxy if acceptable to the Engineer.
 - e. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
 - f. After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete.

END OF SECTION

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Concrete masonry units and accessories.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01312 - Project Meetings.
 - b. Section 01410 - Regulatory Requirements.
 - c. Section 07900 - Joint Sealants.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 530.1 - Specification for Masonry Structures.
- B. ASTM International (ASTM):
 - 1. C 90 - Standard Specification for Loadbearing Concrete Masonry Units.
 - 2. C 140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 3. C 426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.

1.03 DEFINITIONS

- A. Mortar Smears: Mortar paste smeared across the permanent masonry construction during construction and absorbed into the masonry pores.
- B. Mortar Splash: Mortar dropped splashed onto the permanent masonry construction at the base of the wall or off the scaffolding.
- C. Mortar Tag: Excess mortar between masonry units worked out of the joints during tooling or striking.
- D. Mortar Stains: Mortar paste left after mortar tags are removed.

1.04 SUBMITTALS

- A. Product data:
 - 1. Submit manufacturer's product data for standard block.
 - 2. Submit manufacturers' product data for proposed cleaning agent.
- B. Shop drawings: Include elevations of each wall indicating type and layout of units, including type of mortar joints, bond pattern, reinforcing steel, connecting dowels, joint reinforcement, grouted cells, and control joints.
- C. Samples:
 - 1. Contractor shall submit a sample of masonry matching the existing structures at the site for approval by the Owner.
- D. Test reports:
 - 1. Compressive strength.
 - 2. Linear shrinkage.
 - 3. Moisture content as a percentage of total absorption.
 - 4. Total absorption.
 - 5. Unit weight.
- E. Manufacturer's instructions:
 - 1. Submit printed or written recommendations from the masonry unit manufacturer of the cleaning procedures and cleaning agents appropriate for each type of masonry unit included in the work.
- F. Quality assurance submittals:
 - 1. If requested by the Engineer, submit a record of the Installer's evidence of qualifications.
 - 2. If requested by the Engineer, submit a record of the Masonry Cleaner's evidence of qualifications.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer qualifications:
 - a. The mason shall hold an appropriate contractor's license in the State where the work will be constructed.
 - b. The mason shall have not less than 5 years' experience and completed a minimum of 20 projects and at least 5 of which included the type of masonry units specified for this Work.
 - 2. Masonry cleaner qualifications:
 - a. The masonry cleaner shall have not less than 5 years' experience and completed a minimum of 20 projects.
- B. Pre-installation conference: Conduct as specified in Section 01312.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Transport and handle concrete masonry units as required to prevent discoloration, chipping, and breakage.

- B. Store masonry units off the ground in a dry location, covered and protected from absorbing moisture.
 - 1. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
 - 2. If masonry units are delivered in shrink-wrapped packaging and condensation develops, remove shrink-wrap packaging.
- C. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Cold weather requirements:
 - 1. In accordance with building code as specified in Section 01410, provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.
- B. Hot weather requirements:
 - 1. In accordance with building code as specified in Section 01410, when ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
 - 2. Wet mortarboard before loading and cover mortar to retard drying when not being used.
 - 3. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
 - 4. Place masonry units within one minute of spreading mortar.

1.08 SEQUENCING AND SCHEDULING

- A. Order concrete masonry units well before start of installation to ensure adequate time for manufacturing and minimum 28 days for curing and drying before start of installation. Protect from weather after curing period to avoid moisture increase.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Hollow load bearing concrete masonry units:
 - 1. Class: Class 3 in accordance with ASTM C 90, with minimum compressive strength of 1,900 pounds per square inch. Units to have integral water repellent, ACM Chemestries; Rainbloc, Grace Construction Products; Dry-Block or equal.
 - 2. Surface texture: As shown on Drawings
 - 3. Color: Integral, Natural gray of concrete (to match color of existing units at site).
 - 4. Typical size: 8 inches wide by 8 inches high by 16 inches long, unless otherwise indicated on the Drawings, or other sizes as needed to minimize cutting.
 - 5. Special sizes and shapes: As required for window and door openings, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.

- B. Steel reinforcement: As specified in Drawings.
- C. Mortar:
 - 1. Premix Mortar: Packaged blend of Portland cement, Type II, and hydrated lime in compliance to ASTM C 270, Type S. Masonry cements shall NOT be used.
 - 2. Integral waterproofing admixture for mortar: For use with concrete masonry units containing integral water repellent. The Mortar admixture shall be provided by the same manufacturer as the concrete masonry unit integral water repellent admixture.
- D. Grout:
 - 1. Grout: ASTM C-476, 2500 psi compressive strength at 28 days.
 - 2. Aggregate: Sand meeting ASTM C 144; Pearock for grout meeting ASTM C 404, number 89.
 - 3. Mixing water shall be potable.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protection:
 - 1. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of concrete masonry units.
- B. Surface preparation:
 - 1. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other matter that will reduce bond.

3.02 INSTALLATION

- A. Forms and shores:
 - 1. Where required, construct forms to the shapes indicated on the Drawings:
 - a. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
 - b. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
 - 1) Wait at least 24 hours after grouting masonry columns or walls before applying uniform loads.
 - 2. Wait at least 72 hours before applying concentrated loads.
- B. Concrete masonry units:
 - 1. Comply with the requirements of ACI 530.1 unless more restrictive requirements are contained in this Section.
 - 2. Lay concrete masonry units dry.
 - 3. Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units.
 - 4. Lay units to preserve unobstructed vertical continuity of cells to be filled with grout or insulation.
 - 5. Align vertical cells to be filled with grout to maintain clear, unobstructed continuous vertical cell measuring not less than 2 by 3 inches.

6. Ensure full mortar coverage of joints on webs of cells that will be grouted solid, and face shells.
7. Butter vertical head joints for thickness equal to face shell thickness of units, and shove joints tightly together so that mortar bonds to both masonry units.
8. Solidly fill joints from face of units to inside face of cells.
9. Lay units to desired height with joints of uniform thickness.
10. Bond shall be plumb throughout.
11. Lay units to avoid formation of cracks when units are placed. Keep cells of units as free of mortar as possible as masonry wall height increases.
12. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
13. Remove mortar, mortar droppings, debris, and other obstructions and materials from inside of cell walls.
14. Remove mortar tags and smears daily with a non-metallic tool.
 - a. Mortar tags and smears shall be removed after they initially set, but shall not be permitted to remain more than 24 hours.
15. Where practical, protect completed work from mortar splash by placing thin plastic sheeting around the base of walls.
 - a. Place sand, straw, sawdust or other similar material on the floor around the base of walls to protect floors and walls.
16. Turn scaffold planks over at the end of the workday to avoid mortar splashes from wet weather.
 - a. Cover tops of walls at the end of the workday and other work stoppages to prevent entry of water into the partially completed masonry.
17. Seal cleanouts after inspection and before grouting.

C. Bond pattern:

1. Lay concrete masonry units in running bond pattern, unless otherwise indicated on the Drawings.

D. Mortar joints:

1. Make joints straight, clean, smooth, and uniform in thickness.
2. Tool exposed joints, slightly concave. Strike concealed joints flush.
3. Make vertical and horizontal joints 3/8-inch thick.
4. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.
5. Remove mortar that protrudes more than 1/2 inch into the cells of units that are to be grouted.

E. Wire joint reinforcement:

1. Lap splice longitudinal wire joint reinforcement minimum 75 wire diameters.
2. Place longitudinal wires in approximate centers of mortar beds with minimum 5/8-inch mortar cover on exposed faces.
3. Provide intersecting masonry walls with prefabricated wire joint reinforcement tees.
4. Rake intersecting joints 1/2 inch and caulk joints.

F. Grouting and reinforcement:

1. Where horizontal and vertical bars are spliced and adjacent lap splices are separated by more than 3 inches, the lap splice length shall be 72 bar diameters. Where adjacent lap splices are separated by 3 inches or less, the lap splice length shall be increased by 1.3 times or the lap splices shall be staggered at least 24 bar diameters with no increase in length.
2. Hold vertical reinforcing bars in position at top and bottom and at intervals not exceeding 200 bar diameters. Use steel wire bar positioners to position bars. Tie reinforcing bars to dowels with wire ties.
3. Obtain acceptance of reinforcement placement before grouting.
4. Fill spaces and cells containing reinforcing bars solidly with grout.
 - a. Low-lift grouting:
 - 1) Hollow unit masonry to be grouted by the low lift method shall be constructed and grouted in lifts not exceeding 5 feet.
 - 2) Slushing with mortar will not be permitted.
 - b. High-lift grouting:
 - 1) Hollow unit masonry shall be allowed to cure at least 24 hours before grouting.
 - 2) Grout shall be placed in lifts not to exceed 6 feet in depth.
 - 3) Each lift shall be allowed to set for 10 minutes after initial consolidation of grout before successive lift is placed.
 - 4) The full height of each section of wall shall be grouted in 1 day.
5. Grout in cells shall have full contact with surface of concrete footings.
6. When grouting stops for 1 hour or longer, form horizontal construction joints by stopping grout placement 1-1/2 inches below top of uppermost unit containing grout.
7. After placement, consolidate grout using mechanical immersion vibrators designed for consolidating grout.
8. Placement:
 - a. Use a hand bucket, concrete hopper, or grout pump.
 - b. Place grout in final position within 1-1/2 hours after mixing. Place grout so as to completely fill the grout spaces without segregation of the aggregates.
 - c. Do not insert vibrators into lower grout placements that are in a semi-solidified state.
 - d. Remove grout spills immediately by hand washing with a bucket and brush.

G. Bond beams:

1. Starting courses at bottom of walls shall be bond beams.
2. Place horizontal reinforcement and solidly grout bond beam units in place.
3. Provide wire mesh at openings in bottom of bond beams to support grout where walls are not grouted solid.

H. Cutting concrete masonry units:

1. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.
2. Cut and fit units with power-driven carborundum or diamond disc blade saw.

I. Control joints:

1. Provide in masonry walls at locations indicated on the Drawings.

2. Make full height and continuous in appearance.
 3. Run bond beams and bond beam reinforcing bars continuously through control joints.
 4. Insert control joint filler in joints as wall is constructed.
 5. Apply sealant as specified in Section 07900.
- J. Openings and lintels:
1. Place horizontal reinforcement in fully grouted bond beam units.
 2. Use lintel block units where underside of lintel will be exposed.
 3. Provide minimum of 8-inch bearing at each end of lintel.
 4. Embed reinforcing bars minimum 24 inches or 48 bar diameters, whichever is longer, into wall past edges of openings or as indicated on the Drawings:
 - a. At corners, provide 90-degree bend with equivalent total embedment.
- K. Bearing plates:
1. Provide minimum of 12 inches of grouted concrete unit masonry below steel bearing plates and beams bearing on masonry walls.
- L. Anchor bolts:
1. Hold anchor bolts in place with template during grouting to assure precise alignment.
 2. Do not cut or ream members being anchored or use other means to accommodate misaligned anchor bolts in roof deck support angles.
 3. Provide minimum 6-inch wide grouted concrete unit masonry entirely around anchor bolts and other attachment devices.
- M. Enclosures:
1. Where concrete masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are indicated on the Drawings.
 2. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
 3. Do not cover enclosures until inspected and when appropriate, tested.
- N. Other embedded items:
1. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.
- O. Patching:
1. Patch exposed concrete masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.
- P. Water curing:
1. Protect concrete masonry units from drying too rapidly by frequently fogging or sprinkling so walls will always be visibly damp for minimum 3 days.
- Q. Miscellaneous:
1. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

- R. Grouting equipment:
1. Grout pumps:
 - a. Do not pump grout through aluminum tubes.
 - b. Operate pumps to produce a continuous stream of grout without air pockets.
 - c. Upon completion of each days pumping, eject grout from pipeline without contamination or segregation of the grout:
 - 1) Remove waste materials and debris from the equipment.
 - 2) Dispose of waste materials, debris, and all flushing water outside the masonry.
 2. Vibrators:
 - a. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout.
 - b. Maintain at least 1 spare vibrator, at the site at all times.
 - c. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine.
 - d. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

3.03 CONSTRUCTION

- A. Site tolerances: Lay masonry plumb, true to line, and with courses level. Keep bond pattern plumb throughout. Lay masonry within the following tolerances:
1. Maximum variation from the plumb in the lines and surfaces of columns, walls, and in the flutes and surfaces of fluted or split faced blocks:
 - a. In adjacent masonry units: 1/8 inch.
 - b. In 10 feet: 1/4 inch.
 - c. In any story or 20 feet maximum: 3/8 inch.
 - d. In 40 feet or more: 1/2 inch.
 2. Maximum variations from the plumb for external corners, expansion joints, and other conspicuous lines:
 - a. In any story or 20 feet maximum: 1/4 inch.
 - b. In 40 feet or more: 1/2 inch.
 3. Maximum variations from the level or grades indicated on the Drawings for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
 - a. In any bay or 20 feet maximum: 1/4 inch.
 - b. In 40 feet or more: 1/2 inch.
 4. Maximum variations of the linear building lines from established position in plan and related portion of columns, walls, and partitions:
 - a. In any bay or 20 feet maximum: 1/2 inch.
 - b. In 40 feet or more: 3/4 inch.
 5. Maximum variation in cross sectional dimensions of columns and in thickness of walls:
 - a. Minus: 1/4 inch.
 - b. Plus: 1/2 inch.

3.04 FIELD QUALITY CONTROL

- A. Site tests:
1. Owner will have tests performed by an independent laboratory.

2. Have minimum 3 concrete masonry units of each type proposed for Project tested in accordance with ASTM C 90, C 140, and C 426 to verify conformance to Specifications.
3. Tests shall include compressive strength, linear shrinkage, moisture content as percent of total absorption, total absorption, and unit weight.

3.05 FINAL CLEANING

A. General:

1. Final cleaning shall be performed within 7 to 14 days after construction of masonry work.
2. Protect adjacent materials and equipment that may be damaged by cleaning.
3. Pre-wet masonry before applying cleaning agent, but do not saturate masonry.
4. Remove mortar stains, smears, and splash, efflorescence, and grout stains on exposed surfaces with the submitted cleaning agent as directed by the masonry unit manufacturer's recommendations.
5. Do not use muriatic acid as cleaning agent.
6. Cleaning agents shall be applied when the masonry surface and air temperatures are at least 50 degrees Fahrenheit.
 - a. Dilute cleaning agents in accordance with manufacturer's recommendations.
 - b. Do not allow cleaning agents to dry on the masonry.
7. Clean wall from the top to the bottom, without overlapping areas being cleaned for consistency.
8. If pressure cleaning equipment is used, the following limitations shall be observed:
 - a. Apply cleaning agent to pre-wetted wall with low pressure (less than 50 pounds per square inch).
 - b. Use a 25° to 50° flared-tip nozzle (not a pointed tip).
 - c. Maintain a consistent distance from the spray nozzle to the masonry surface no closer than 12 inches.
 - 1) Masonry cleaner shall use a combination of pressure, nozzle, and distance from tip to masonry that does not damage the masonry surface.
9. Rinse cleaning agents off the wall with potable water.
10. Dispose of debris, refuse, and surplus material offsite legally.

3.06 PROTECTION

- #### **A. Provide temporary protection for exposed masonry corners subject to damage.**
- #### **B. Bracing:**
1. Unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse, adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse.
 2. Keep bracing in place until permanent supporting elements of structure are in place.
- #### **C. Limited access zone:**
1. Establish limited access zone prior to start of masonry wall construction.
 2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.

3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Structural steel shapes and plate.
 - 2. Fasteners and structural hardware:
 - a. All thread rods.
 - b. Forged steel structural hardware.
 - c. High-strength bolts.
 - 3. Welding.
 - 4. Bolting.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

1.02 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. 303 - Code of Standard Practice for Steel Buildings and Bridges.
 - 2. 360 - Specification for Structural Steel Buildings.
- B. American Iron and Steel Institute (AISI):
 - 1. Steel and stainless steel alloys ("types") as indicated.
- C. American Welding Society (AWS):
 - 1. A5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 - 2. A5.17 - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
 - 3. A5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
 - 4. D1.1 - Structural Welding Code - Steel.
 - 5. D1.6 - Structural Welding Code - Stainless Steel.
- D. ASTM International (ASTM):
 - 1. A 6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
 - 2. A 36 - Standard Specification for Carbon Structural Steel.
 - 3. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
 - 4. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

5. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 6. A 193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
 7. A 194 - Standard Specification for Steel Bars Subject to Restricted End-Quench Hardenability Requirements.
 8. A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 9. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 10. A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 11. A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
 12. A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 13. A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 14. A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
 15. A 992 - Standard Specification for Structural Steel Shapes.
 16. F 436 - Standard Specification for Hardened Steel Washers.
 17. F 959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
 18. F 2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- E. Research Council on Structural Connections (RCSC):
1. Specification for Structural Joints Using High-Strength Bolts (RCSC Specification).

1.03 DEFINITIONS

- A. Snug-tight: At bolted joints, the tightness attained with a few impacts of an impact wrench, or by the full effort of an ironworker using a spud wrench to bring the connected plies into firm contact.
- B. Stainless steel related terms:
1. Descaling: Removal of heavy, tightly adherent oxide films resulting from hot-forming, heat-treatment, welding, and other high-temperature operations.
 2. Pickling: Chemical descaling of stainless steel using aqueous solutions of nitric and hydrofluoric acid, or various proprietary formulations as specified.
 3. Passivation: Chemical treatment of stainless steel with a mild oxidant for the purpose of enhancing the spontaneous formation of the steel's protective passive film.

1.04 SUBMITTALS

- A. General: As specified in:
1. Section 01330 Submittal Procedures; and
 2. This Section

- B. Quality control submittals:
 1. Submit shop drawings of members to be fabricated before starting fabrication.
 2. Welder's certificates.
- C. Test reports:
 1. Certified copies of mill tests and analyses made in accordance with applicable ASTM standards, or reports from a recognized commercial laboratory, including chemical and tensile properties of each shipment of structural steel or part thereof having common properties.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 1. Perform welding of structural metals with welders who have current AWS certificate for the type of welding to be performed.
 2. Steel fabricators shall be certified by the AISC or other certification as recognized and accepted by the local building official having jurisdiction.
 3. Notify Design Engineer 24 hours minimum before starting field welding.
 4. Design Engineer may check materials, equipment, and qualifications of welders.
 5. Remove welders performing unsatisfactory Work, or require to requalification.
 6. Design Engineer may use gamma ray, magnetic particle, dye penetrant, trepanning, or other aids to visual inspection to examine any part of welds or all welds.
 7. Contractor shall bear costs of retests on defective welds.
 8. Contractor shall also bear costs in connection with qualifying welders.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and shipping: Deliver structural steel free from mill scale, rust, and pitting.
- B. Storage and protection: Until erection and painting, protect from weather items not galvanized or protected by a shop coat of paint.
- C. Do not store metal fabrication in direct contact with the ground.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Unless otherwise specified or indicated on the Drawings, materials shall conform to the following:

Item	ASTM Standard	Class, Grade, Type, or Alloy Number
Steel		
Plate, bars, rolled shapes (except W and WT shapes), and miscellaneous items	A 36	--
Rolled W and WT shapes	A 992	Grade 50

Item	ASTM Standard	Class, Grade, Type, or Alloy Number
Hollow structural sections (HSS): Round, square, or rectangular	A 500	Grade B
Round HSS	A 500	Grade B
Steel pipe	A 53	Grade B
Stainless steel		
Plate, sheet, and strip	A 240	Type 304* or 316**
Bars and shapes	A 276	Type 304* or 316**
* Use Type 304L if material will be welded.		
** Use Type 316L if material will be welded.		

- B. Where stainless steel is welded, use extra low-carbon stainless steel (304L or 316L).

2.02 FASTENERS AND STRUCTURAL HARDWARE

- A. General:
1. Materials: Of domestic manufacture.
 2. Where fasteners and hardware are specified to be galvanized, galvanize in accordance with ASTM A 153 or ASTM F 2329.
- B. All thread rods:
1. Uncoated
 - a. In accordance with ASTM A 36 unless otherwise indicated on the Drawings.
 - b. Nuts: ASTM A 194.
 - c. Washers: ASTM F 436.
 2. Galvanized:
 - a. In accordance with ASTM A 36 unless otherwise indicated on the Drawings, and hot dip galvanized in accordance with ASTM A 123.
 - b. Nuts : ASTM A 194, hot-dip galvanized in accordance with ASTM A 153.
 - c. Washers: ASTM F 436, hot-dip galvanized in accordance with ASTM A 153.
 3. Stainless steel:
 - a. Units descaled, pickled, and passivated as specified in "Fabrication" in this Section.
 - b. Threaded rods and nuts to be the products of a single manufacturer/fabricator to ensure proper fit without galling. Ship threaded rods with properly fitting nuts attached.
 - c. Alloy: Type 316/316L:
 - 1) Bolts: ASTM A 193, Grade B8M, Class 1, heavy hex.
 - 2) Nuts: ASTM A 194, Grade 8M, heavy hex.
 - 3) Washers: Type 316 stainless steel.
- C. Anchor bolts, anchor rods, and post-installed steel anchors: As indicated on the Drawings and as specified in Section 05190.

1. Provide high-strength bolt assembly, with nuts, hardened flat washers, and compressible-washer-type direct tension indicators.
2. Uncoated:
 - a. Bolts: Plain heavy hex structural bolts in accordance with ASTM A 325
Type 1 Nuts: Heavy hex nuts in accordance with ASTM A 563, Grade C.
 - b. Washers: Flat:
 - 1) Adjacent to normal, oversized, and short-slotted holes: Circular and square or rectangular beveled washers in accordance with ASTM F 436.
 - 2) Adjacent to long slotted holes: 5/16-inch thick plate washer fabricated from steel in accordance with ASTM A 36.
 - c. Washers: Tension indicating: In accordance with ASTM F 959.
3. Galvanized:
 - a. Bolt and nut assemblies fabricated, galvanized, tested for rotational capacity, and shipped accordance with the provisions ASTM A 325 and the RCSC Specification.
 - b. Bolts, nuts, and washers: Hot-dip galvanized and in accordance with ASTM A 153, Class C or ASTM F 2329.
 - c. Bolts: Plain heavy hex structural bolts in accordance with ASTM A 325 Type 1 and galvanized as specified.
 - d. Nuts: Heavy hex nuts in accordance with ASTM A 563, Grade DH, galvanized as specified, and lubricated in accordance with ASTM A 563, Supplementary Requirement S1 to minimize galling.
 - e. Washers:
 - 1) Adjacent to normal, oversized, and short-slotted holes: Circular and square or rectangular beveled washers in accordance with ASTM F 436 and galvanized as specified.
 - 2) Adjacent to long slotted holes: 5/16-inch thick plate washer fabricated from steel in accordance with ASTM A 36, and galvanized in accordance with ASTM A 123.

2.03 ISOLATING SLEEVES AND WASHERS

- A. As indicated on the Drawings and as specified in Section 05190.

2.04 SUPPLEMENTARY PARTS

- A. Furnish as required for complete structural steel erection, whether or not such parts and Work are specified or indicated on the Drawings.

2.05 FABRICATION

- A. Shop assembly:
 1. Fabricate structural steel in accordance with AISC 360 and AISC 303 unless otherwise specified or modified by applicable regulatory requirements.
 2. Where anchors, connections, or other details of structural steel are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.
 3. Round off sharp and hazardous projections and grind smooth.
 4. Take measurements necessary to properly fit work in the field. Take responsibility for and be governed by the measurements and proper working out of all the details.

5. Take responsibility for correct fitting of all metalwork.
- B. Stainless steel shapes and assemblies:
1. For structural members such as W shapes, S shapes, channels, angles, and similar rolled shapes not available in quantity, size, and type of stainless steel specified or indicated on the Drawings:
 - a. Fabricate shapes using laser-fused, full penetration welds between pieces of plate to attain same or higher section modulus and moment of inertia as that of members indicated on the Drawings.
 - b. Fabricate shapes from dual grade stainless steel.
 - c. Fabricate beams and channels to ASTM A 6 tolerances.
 - d. Manufacturers: The following, or equal:
 - 1) Stainless Structurals, LLC, Jacksonville, FL.
 2. Cleaning and passivation:
 - a. Following shop fabrication of stainless steel members and bolts, clean and passivate fabrications at point of manufacture.
 - b. Finish requirements: Remove free iron, heat tint oxides, weld scale and other impurities, and obtain a bright passive finished surface with no etching, pitting, frosting, or discoloration.
 - c. Provide quality control testing to verify effectiveness of cleaning agents and procedures and to confirm that finished surfaces are clean and passivated:
 - 1) Conduct sample runs using test specimens with proposed cleaning agents and procedures as required to avoid adverse effects on surface finishes and base materials.
 - d. Pre-clean, chemically de-scale ("pickle"), passivate, and final-clean fabrications in accordance with the requirements of ASTM A 380:
 - 1) If degreasing is required before cleaning (pickling) to remove scale or iron oxide, cleaning with citric acid treatments is permissible; however, such treatments shall be followed inorganic cleaners.
 - 2) Pickle and passivate stainless steel using a nitric acid solution in accordance with ASTM A 380, Annex A2, Table A2.1, Part II.
 - 3) Pickling by citric acid treatment or sulfuric acid treatment is not considered to satisfy the requirements of this Section.
 - e. Inspect after cleaning using methods specified for "gross inspection" in ASTM A 380.
 - f. Improperly or poorly cleaned and passivated materials shall not be shipped and will not be accepted at the site.
- C. Galvanized steel:
1. Where galvanizing is required, hot-dip structural steel after fabrication in accordance with ASTM A 123:
 2. Do not electro-galvanize or mechanically-galvanize unless specified or accepted by Design Engineer.
 3. Re-straighten galvanized items that bend or twist during galvanizing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 ERECTION

- A. General:
 - 1. Fabricate structural and foundry items to true dimensions without warp or twist.
 - 2. Form welded closures neatly, and grind off smooth where weld material interferes with fit or is unsightly.
 - 3. Install structural items accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting structure or equipment for which intended.
 - 4. Do not cock out of alignment, re-drill, re-shape, or force fit fabricated items.
 - 5. Place anchor bolts or other anchoring devices accurately and make surfaces that bear against structural items smooth and level.
 - 6. Rigidly support and brace structural items needing special alignment to preserve straight, level, even, and smooth lines. Keep structural items braced until concrete, grout, or dry pack mortar has hardened for 48 hours minimum.
 - 7. Erect structural steel in accordance with AISC 360 unless otherwise specified or modified by applicable regulatory requirements.
 - 8. Where anchors, connections, and other details of structural steel erection are not specifically indicated on the Drawings or specified, form, locate, and attach with equivalent in quality and workmanship to items specified.
 - 9. Round off sharp or hazardous projections and grind smooth.
 - 10. Paint or coat steel items as specified in Sections 09910 and 09960.
- B. Stainless steel. Take all necessary precautions to avoid iron contamination of stainless steel during delivery, storage, and handling:
 - 1. Segregate stainless steel from iron.
 - 2. Tools and handling devices:
 - a. Do not use iron tools clamps, chokes, working surfaces, or brushes when fabricating, handling, and erecting stainless steel.
 - b. Do not use tools that have been contaminated by contact with iron.
 - c. Use stainless steel, polymer coated, or wood tools and handling equipment. Do not use tools that have been contaminated by contact with iron or steel.
- C. Welding: General:
 - 1. Make welds full penetration type, unless otherwise indicated on the Drawings.
 - 2. Remove backing bars and weld tabs after completion of weld. Repair defective welds observed after removal of backing bars and weld tabs.
- D. Welding stainless steel:
 - 1. General: In accordance with AWS D1.6.

- E. Welding carbon steel:
 - 1. General: In accordance with AWS D1.1:
 - a. Weld ASTM A 36 and A 992 structural steel, ASTM A 500 and A 501 structural tubing, and ASTM A 53 pipe with electrodes conforming to AWS A5.1, using E70XX electrodes; AWS A5.17, using F7X-EXXX electrodes; or AWS A5.20, using E7XT-X electrodes:
 - b. Field repair cut or otherwise damaged galvanized surfaces to equivalent original condition using a galvanized surface repair.
- F. Interface with other products:
 - 1. Where steel members and fasteners come in contact with dissimilar metals (aluminum, stainless steel, etc.), separate or isolate the dissimilar metals with isolating sleeves and washers as specified in Section 05190.
- G. Fasteners: General:
 - 1. Install bolts to project 2 threads minimum, but 1/2 inch maximum beyond nut.
 - 2. Anchor bolts and anchor rods: Install as specified in Section 05190.
 - a. Unless otherwise specified, tighten nuts on anchor bolts and anchor rods specified in Section 05190 to the "snug-tight" condition.
 - 3. All thread rods in drilled holes and bonded to concrete with epoxy.
- H. Fasteners: High-strength bolts:
 - 1. Connections with high-strength bolts shall in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts.
 - 2. Joints: Slip-critical.
 - a. Confirm that faying surfaces at connections are free of dirt and other foreign material, have been blast cleaned, and are free of coatings and inadvertent overspray in accordance with RCSC Specification.
 - b. Furnish hardened flat washers in accordance with ASTM F 436:
 - 1) On outer plies with slotted holes.
 - 2) When 1 or more plies of the connected material has a yield strength less than 40 ksi.
 - 3) Under element, nut, or bolt head, turned in tightening.
 - c. Install tension indicator washers, placed in accordance with ASTM F 959 Figure X1, to confirm adequate tightening of bolts.
 - d. Tighten bolts to full pretension.
- A. Fasteners: Stainless steel bolts:
 - 1. Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.
 - 2. Rotate nuts using a slow, smooth action without interruptions. Avoid over-tightening.

END OF SECTION

SECTION 05140
STRUCTURAL ALUMINUM

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Structural aluminum products, including sheet, pipe, extrusions, and associated accessories.
- B. Related Sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
 - b. Section 09960 - High-Performance Coatings.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 3. B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
- B. American Welding Society (AWS):
 - 1. A5.10 - Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.
 - 2. D1.2 - Structural Welding Code - Aluminum.

1.03 SUBMITTALS

- A. Quality control submittals:
 - 1. Test Reports: Certified copies of mill tests or reports from a recognized commercial laboratory including chemical and tensile properties of each shipment of structural metal or part thereof having common properties. Tests and analyses shall be made in accordance with applicable ASTM Standards.
 - 2. Welder's certificates.

1.04 QUALITY ASSURANCE

- A. Qualifications:
1. Perform welding of structural metals with welders who have current AWS certificate for the type of welding to be performed.
 2. Notify Engineer 24 hours minimum before starting shop or field welding.
 3. Engineer may check materials, equipment, and qualifications of welders.
 4. Remove welders performing unsatisfactory work, or require to requalify.
 5. Engineer may use gamma ray, magnetic particle dye penetrant, or other aids to visual inspection to examine any part of welds or all welds.
 6. Contractor shall bear costs of retests on defective welds.
 7. Contractor shall bear costs in connection with qualifying welders.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Structural sheet aluminum: ASTM B 209, Alloy 6061-T6.
- B. Structural aluminum: ASTM B 308, Alloy 6061-T6.
- C. Extruded aluminum: ASTM B 221, Alloy 6063-T42.
- D. Miscellaneous materials:
1. Furnish supplementary parts necessary to complete each item even where such work is neither definitely indicated on the Drawings nor specified.
 2. Size, form, attachment, and location shall conform to the best of current practice.
 3. Conform to applicable ASTM Standards for materials not otherwise specified.

2.02 FABRICATION

- A. Aluminum layout:
1. Center punch hole centers, and punch or scribe cutoff lines, except where marks would remain on fabricated material.
 2. Apply temperature correction where necessary in layout of critical dimensions. Use a coefficient of expansion of 0.00013 per degree of Fahrenheit.
- B. Cutting aluminum:
1. Material 1/2-inch thick or less: Shear, saw, or cut with a router.
 2. Material more than 1/2-inch thick: Saw or rout.
 3. Make cut edges true and smooth, free from excessive burrs or ragged breaks.
 4. Avoid reentrant cuts wherever possible. Where used, fillet by drilling prior to cutting.
 5. Do not flame cut aluminum alloys.
 6. Punch or drill rivet or bolt holes to finished size before assembly:
 - a. Make finished diameter of holes for bolts 1/16-inch maximum larger than nominal bolt diameter.
 - b. Make holes cylindrical and perpendicular to principal surface.
 - c. Do not permit holes to drift in a manner to distort metal.

- C. Aluminum forming and assembly:
 - 1. Do not heat structural aluminum, except as follows:
 - a. Heat aluminum to 400 degrees Fahrenheit for 30 minutes maximum, to facilitate bending or welding.
 - b. Heat only when proper temperature controls and supervision can ensure that limitations on temperature and time are observed.
- D. Before assembly, remove chips lodged between contacting surfaces.
- E. Welding aluminum:
 - 1. Perform welding of aluminum in accordance with AWS D1.2.
 - 2. Weld aluminum in accordance with the following:
 - a. Preparation:
 - 1) Remove dirt, grease, forming or machining lubricants, and organic materials from areas to be welded by cleaning with a suitable solvent or by vapor degreasing.
 - 2) Additionally, etch or scratch brush to remove oxide coating just prior to welding when inert gas tungsten arc welding method is used.
 - 3) Oxide coating may not need to be removed if welding is performed by automatic or semi-automatic inert gas shielded metal arc.
 - 4) Suitably prepare edges to assure 100 percent penetration in butt welds by sawing, chipping, machining, or shearing. Do not cut with oxygen.
 - b. Filler metal: Aluminum alloys conforming to the requirements of AWS A5.10 and AWS classification ER 4043, ER 5654, ER 5554, ER 5183, ER 5356, or ER 5556.
 - c. Perform welding of structures which are to be anodized using filler alloys which will not discolor when anodized, AWS ER 5654, ER 5554, ER 5183, ER 5356, or ER 5556.
 - d. Perform welding by using a non-consumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG).
 - e. Do not use welding process that requires use of a welding flux.
 - f. Neatly make welded closures.
 - g. Where weld material interferes with fit or is unsightly in appearance, grind it smooth.
 - h. Make welds full penetration welds unless otherwise indicated on the Drawings.

2.03 FINISHES

- A. Coating for dissimilar metals:
 - 1. Alkali resistant bitumastic: Manufacturers: One of the following or equal:
 - a. Caroline, Bitumastic Super Service Black.
 - b. Tnemec, 46-465.
 - c. Wasser, MC-Tar.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions: Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 INSTALLATION

- A. Install structural aluminum products as indicated on the Drawings and specified.
- B. Install structural aluminum products accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting structure or equipment for which intended.
- C. Do not cock out of alignment, redrill, reshape, or force fit fabricated items.
- D. Place anchor bolts or other anchoring devices accurately and make surfaces which bear against structural items smooth and true to level.
- E. Rigidly support and brace structural products needing special alignment to preserve straight, level, even, smooth lines, and keep braced until concrete, grout, or dry pack mortar has hardened for a minimum 48-hour period.
- F. Interface with other products:
 - 1. Where aluminum comes in contact with dissimilar metals, bolt it with stainless steel bolts and separate or isolate it from dissimilar metals as specified in Section 05190.
 - 2. Do not paint exposed aluminum surfaces. Remove markings and leave surfaces clean. Coat those parts of aluminum which will be cast into concrete, and those parts of aluminum which will come in contact with masonry, concrete, or wood, with a minimum of 2 coats of specified coating for protection of similar metals.
 - 3. Coat those parts of aluminum which will be cast into concrete or which will be in contact with concrete, grout, masonry, wood, or other materials that will cause the aluminum to corrode, as specified in Section 09960.

END OF SECTION

SECTION 05190

MECHANICAL ANCHORING AND FASTENING TO CONCRETE AND MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Cast-in anchors and fasteners:
 - a. Anchor bolts.
 - b. Welded studs.
 - 2. Post-installed steel anchors and fasteners
 - a. Concrete anchors.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittals.

1.02 REFERENCES

- A. American Concrete Institute (ACI)
 - 1. 355.2 - Qualification of Post-Installed Mechanical Anchors in Concrete & Commentary.

- B. American National Standards Institute (ANSI):
 - 1. B212.15 - Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.

- C. American Welding Society (AWS):
 - 1. D1.1 - Structural Welding Code - Steel.
 - 2. D1.6 - Structural Welding Code - Stainless Steel.

- D. ASTM International (ASTM):
 - 1. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. A 108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
 - 3. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

5. A 193 - Standard Specification for Alloy Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
 6. A 194 - Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
 7. A 240 - Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 8. A 308 - Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot-Dip Process.
 9. A 496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 10. A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
 11. B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 12. B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 13. E 488 - Standard Test Methods for Strength of Anchors in Concrete Elements.
 14. F 436 - Standard Specification for Hardened Steel Washers.
 15. F 1554 - Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
- E. International Code Council Evaluation Service, Inc. (ICC-ES):
1. AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

1.03 DEFINITIONS

- A. Built-in anchor: Headed bolt or assembly installed in position before filling surrounding masonry units with grout.
- B. Cast-in anchor: Headed bolt or assembly installed in position before placing plastic concrete around.
- C. Overhead installations: Fasteners installed on overhead surfaces where the longitudinal axis of the fastener is more than 60-degrees above a horizontal line so that the fastener resists sustained tension loads.
- D. Passivation: Chemical treatment of stainless steel with a mild oxidant for the purpose of enhancing the spontaneous formation of the steel's protective passive film.
- E. Post-installed anchor: Fastener or assembly installed in hardened concrete or finished masonry construction, typically by drilling into the structure and inserting a steel anchor assembly.
- F. Terms relating to structures or building environments as used with reference to anchors and fasteners:
 1. Corrosive locations: Describes interior and exterior locations as follows:
 - a. Locations used for delivery, storage, transfer, or containment (including spill containment) of chemicals used for plant treatment processes.

2. Wet and moist locations: Describes locations, other than “corrosive locations,” that are submerged, are immediately above liquid containment structures, or are subject to frequent wetting, splashing, or wash down. Includes:
 - a. Exterior portions of buildings and structures.
 - b. Liquid-containing structures:
 - 1) Locations at and below the maximum operating liquid surface elevation.
 - 2) Locations above the maximum operating liquid surface elevation and:
 - a) Below the top of the walls containing the liquid;
 - b) At the inside faces and underside surfaces of a structure enclosing or spanning over the liquid (including walls, roofs, slabs, beams or walkways enclosing the open top of the structure).
 - c. Liquid handling equipment:
 - 1) Bases of pumps and other equipment that handles liquids.
 - d. Indoor locations exposed to moisture, splashing or routine wash down during normal operations, including floors with slopes toward drains or gutters.
 - e. Other locations indicated on the Drawings.
3. Other locations:
 - a. Interior dry areas where the surfaces are not exposed to moisture or humidity in excess of typical local environmental conditions.

1.04 SUBMITTALS

- A. General:
 1. Submit as specified in Section 01330.
 2. Submit information listed for each type of anchor or fastener to be used.
- B. Action submittals:
 1. Product data:
 - a. Cast-in anchors.
 - 1) Manufacturer’s data including catalog cuts showing anchor sizes and configuration, materials, and finishes.
 - b. Post-installed anchors.
 - 1) For each anchor type, manufacturer’s data including catalog cuts showing anchor sizes and construction, materials and finishes, and load ratings .
 2. Samples:
 - a. Samples of each type of anchor, including representative diameters and lengths, if requested by the Engineer.
 3. Certificates:
 - a. Cast-in anchors:
 - 1) Mill certificates for steel anchors that will be supplied to the site.
 - b. Post-installed anchors:
 - 1) Manufacturer’s statement or certified test reports demonstrating that anchors that will be supplied to the site comply with the materials properties specified.

4. Test reports:
 - a. Post-installed anchors: For each anchor type used for the Work:
 - 1) Current ICC-ES Report (ESR), or equivalent acceptable to the Engineer and the authority having jurisdiction, demonstrating:
 - a) Acceptance of that anchor for use under the building code specified in Section 01410.
5. Manufacturer's instructions.
 - a. Requirements for storage and handling.
 - b. Recommended installation procedures including details on drilling, hole size (diameter and depth), hole cleaning and preparation procedures, anchor insertion, and anchor tightening.
 - c. Requirements for inspection or observation during installation.
6. Qualification statements.
 - a. Post-installed anchors: Installer qualifications:
 - 1) Submit list of personnel performing installations and include date of manufacturer's training for each.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 1. Post installed anchors shall be in accordance with building code specified in Section 01410.
- B. Special inspection:
 1. Provide special inspection of post-installed anchors.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver post-installed anchors in manufacturer's standard packaging with labels visible and intact. Include manufacturer's installation instructions.
- B. Handle and store anchors and fasteners in accordance with manufacturer's recommendations and as required to prevent damage.
- C. Protect anchors from weather and moisture until installation.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. General:
 1. Furnish threaded fasteners with flat washers and hex nuts fabricated from materials corresponding to the material used for threaded portion of the anchor.
 - a. Cast-in anchors: Provide flat washers and nuts as listed in the ASTM standard for the anchor materials specified.
 - b. Post-installed anchors: Provide flat washers and nuts supplied for that product by the manufacturer of each anchor.
 2. Size of anchors and fasteners, including diameter and length or minimum effective embedment depth: As indicated on the Drawings or as specified in this Section. In the event of conflicts, contact Engineer for clarification.

3. Where anchors and connections are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.

B. Materials:

1. Provide and install anchors of materials as in this Section.

2.02 CAST-IN ANCHORS AND FASTENERS

A. Anchor bolts:

1. Description:

- a. Straight steel rod having one end with integrally forged head, and one threaded end. Embedded into concrete with the headed end cast into concrete at the effective embedment depth indicated on the Drawings or specified, and with the threaded end left to project clear of concrete face as required for the connection to be made.
- b. Furnish anchor bolts with heavy hex forged head or equivalent acceptable to Engineer.
 - 1) Rods or bars with angle bend for embedment in concrete (i.e.: "L" or "J" shaped anchor bolts) are not permitted in the Work.

2. Materials:

- a. Type 316 stainless steel.
 - 1) Bolts: ASTM A 193, Grade B8M, Class 1, heavy hex.
 - 2) Nuts: ASTM A 194, Grade 8M, heavy hex.
 - 3) Washers: Type 316 stainless steel.

2.03 POST-INSTALLED ANCHORS AND FASTENERS – ADHESIVE

- A. Epoxy bonding of reinforcing bars, all thread rods, and threaded inserts in concrete: As specified in Section 03055.

2.04 POST-INSTALLED ANCHORS AND FASTENERS – MECHANICAL

A. General:

1. Post-installed anchors used for the Work shall hold a current ICC Evaluation Service Report demonstrating acceptance for use under the building code specified in Section 01410
 - a. Conditions of use: The acceptance report shall indicate acceptance of the product for use under the following conditions:
 - 1) In regions of concrete where cracking has occurred or may occur.
 - 2) To resist short-term loads due to wind forces.
 - 3) To resist short-term loading due to seismic forces for the Seismic Design Category of the structure where the product will be used.
2. Substitutions: When requesting product substitutions, submit calculations, indicating the diameter, effective embedment depth and spacing of the proposed anchors, and demonstrating that the substituted product will provide load resistance that is equal to or greater than that provided by the anchors listed in this Section.
 - a. Calculations shall be prepared by and shall bear the signature and sealed of a Professional Engineer licensed in the State of Florida.
 - b. Decisions regarding the acceptability of proposed substitutions shall be at the discretion of the Engineer.

- B. Concrete anchors:
1. Description. Post-installed anchor assembly consisting of a threaded stud and a surrounding wedge expansion sleeve that is forced outward by torquing the center stud to transfer loads from the stud to the concrete through bearing, friction, or both. (Sometimes referred to as “expansion anchors” or “wedge anchors.”)
 - a. Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials to develop holding power.
 2. Concrete anchors for anchorage to concrete:
 - a. Acceptance criteria.
 - 1) Concrete anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and with ICC-ES AC193 (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
 - 2) Concrete anchor performance in the current ICC-ES Report shall be “Category 1” as defined in ACI 355.2.
 - b. Manufacturers: One of the following or equal:
 - 1) Hilti: Kwik Bolt TZ Expansion Anchor.
 - 2) Powers fasteners: PowerStud+ SD2.
 - 3) Simpson Strong-Tie®: Strong Bolt 2 Wedge Anchor.
 - c. Materials. Integrally threaded stud, wedge, washer and nut:
 - 1) Stainless steel: Type 316.
- C. Flush shells:
1. Description: Post-installed anchor assembly consisting of an internally threaded mandrel that is forced into a pre-drilled concrete hole with a setting tool until the top of the anchor is flush with the face of the concrete. Once installed, a removable threaded bolt is installed in the mandrel.
 2. Flush shell anchors are not permitted in the Work.

2.05 APPURTENANCES FOR ANCHORING AND FASTENING

- A. Anchor bolt sleeves
1. having inside diameter approximately 2 inches greater than bolt diameter and minimum 10-bolt diameters long.
 2. Plastic sleeves:
 - a. High-density polyethylene, corrugated sleeve, threaded to provide adjustment of location on the anchor bolt.
 - b. Manufacturers: One of the following, or equal:
 - 1) Wilson Anchor Bolt Sleeve Company.
- B. Isolating sleeves and washers.
1. Manufacturers: One of the following or equal:
 - a. Central Plastics Company, Shawnee, Oklahoma.
 - b. Corrosion Control Products, PSI Inc., Gardena, CA.
 2. Sleeves: Mylar, 1/32 inch thick, 4,000 volts per mil dielectric strength, of proper size to fit bolts and extending half way into both steel washers.
 3. One sleeve required for each bolt.

4. Washers: The inside diameter of all washer shall fit over the isolating sleeve and both the steel and isolating washers shall have the same inside diameter and outside diameter.
 - a. Proper size to fit bolts. 2 insulating washers are required for each bolt.
 - b. Two 1/8-inch thick steel washers for each bolt.
 - c. G3 Phenolic:
 - 1) Thickness: 1/8 inch.
 - 2) Base material: Glass.
 - 3) Resin: Phenolic.
 - 4) Water absorption: 2 percent.
 - 5) Hardness (Rockwell): 100.
 - 6) Dielectric strength: 450 volts per mil.
 - 7) Compression strength: 50,000 pounds per square inch.
 - 8) Tensile strength: 20,000 pounds per square inch.
 - 9) Maximum operating temperature: 350 degrees Fahrenheit.
- C. Coating for repair of galvanized surfaces.
 1. Manufacturers: One of the following or approved equal:
 - a. Galvinox.
 - b. Galvo-Weld.
- D. Thread coating. For use with threaded stainless steel fasteners.
 1. Manufacturers: One of the following or equal:
 - a. Never Seez Compound Corporation, Never-Seez.
 - b. Oil Research, Inc., WLR No. 111.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 INSTALLATION: GENERAL

- A. Where anchors and fasteners are not specifically indicated on the Drawings or specified, make attachments with materials specified in this Section.
- B. Substitution of anchor types.
 1. Post-installed anchors may not be used as an alternative to cast-in / built-in anchors at locations where the latter are indicated on the Drawings.
 2. Cast-in/built-in anchors may be used as an alternative to post-installed mechanical anchors at locations where the latter are indicated on the Drawings.
- C. Protect products from damage during installation. Take special care to protect threads and threaded ends.
- D. Accurately locate and position anchors and fasteners.
 1. Unless otherwise indicated on the Drawings, install anchors perpendicular to the surfaces from which they project.

2. Install anchors so that at least 2 threads, but not more than 1/2 inch of threaded rod, projects past the top nut.
- E. Interface with other products:
1. Where steel anchors come in contact with dissimilar metals (aluminum, stainless steel, etc.), bolt with stainless steel bolts and separate or isolate dissimilar metals using isolating sleeves and washers.
 2. Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.

3.03 INSTALLATION: CAST-IN ANCHORS

- A. General
1. Accurately locate cast-in and built-in anchors.
 - a. Provide anchor setting templates to locate anchor bolts and anchor rods. Secure templates to formwork.
 - b. Brace or tie off embedments as necessary to prevent displacement during placement of plastic concrete or of surrounding masonry construction.
 - c. Position and tie cast-in and built-in anchors in place before beginning placement of concrete or grout. Do not “stab” anchors into plastic concrete, mortar, or grout.
 - d. Do not allow cast-in anchors to touch reinforcing steel. Where cast-in anchors are within 1/4 inch of reinforcing steel, isolate the metals by wrapping the anchors with a minimum of 4 wraps of 10-mil polyvinyl chloride tape in area adjacent to reinforcing steel.
 2. For anchoring at machinery bases subject to vibration, use 2 nuts, with 1 serving as a locknut.
 3. Where anchor bolts or anchor rods are indicated on the Drawings as being for future use, thoroughly coat exposed surfaces that project from concrete or masonry with non-oxidizing wax. Turn nuts down full length of the threads, and neatly wrap the exposed thread and nut with a minimum of 4 wraps of 10-mil waterproof polyvinyl tape.
- B. Anchor bolts:
1. Minimum effective embedment: 10-bolt diameters, unless a longer embedment is indicated on the Drawings.
 2. Where indicated on the Drawings, set anchor bolts in 316 stainless steel sleeves to allow for adjustment.

3.04 INSTALLATION: POST-INSTALLED ADHESIVE ANCHORS.

- A. Epoxy and acrylic adhesive bonding of reinforcing bars, all thread rods, and internally threaded inserts in concrete.

3.05 INSTALLATION: POST-INSTALLED MECHANICAL ANCHORS.

- A. General:
1. Install anchors in accordance with the manufacturer’s instructions, ACI 355.2, the anchor’s ICC-ES Report. Where conflict exists between the ICC-ES Report and the requirements in this Section, the requirements of the ICC-ES Report shall control.
 2. Where anchor manufacturer recommends the use of special tools and/or specific drill bits for installation, provide and use such tools.

3. After anchors have been positioned and inserted into concrete or masonry, do not:
 - a. Remove and reuse/reinstall anchors.
 - b. Loosen or remove bolts or studs.
- B. Holes drilled into concrete and masonry.
 1. Do not drill holes in concrete or masonry until the material has achieved its minimum specified compression strength ($f'c$ or $f'm$).
 2. Accurately locate holes.
 - a. Before drilling holes, use a reinforcing bar locator to identify the position of all reinforcing steel, conduit, and other embedded items within a 6-inch radius of each proposed hole.
 - b. If the hole depth exceeds the range of detection for the rebar locator, the Engineer may require radiographs of the area designated for investigation before drilling commences.
 3. Exercise care to avoid damaging existing reinforcement and other items embedded in concrete and masonry.
 - a. If embedments are encountered during drilling, immediately stop work and notify the Engineer. Await Engineer's instructions before proceeding.
 4. Unless otherwise indicated on the Drawings, drill holes perpendicular to the concrete surface into which they are placed.
 5. Drill using anchor manufacturer's recommended equipment and procedures.
 - a. Unless otherwise recommended by the manufacturer, drill in accordance with the following:
 - 1) Drilling equipment: Electric or pneumatic rotary type with light or medium impact. Where edge distances are less than 2 inches, use lighter impact equipment to prevent micro-cracking and concrete spalling during drilling process.
 - 2) Drill bits: Carbide-tipped in accordance with ANSI B212-15. Hollow drills with flushing air systems are preferred.
 6. Drill holes at manufacture's recommended diameter and to depth required to provide the effective embedment indicated.
 7. Clean and prepare holes as recommended by the manufacturer and as required by the ICC-ES Report for that anchor.
 - a. Unless otherwise recommended by anchor manufacturer, remove dust and debris using brushes and clean compressed air.
 - b. Repeat cleaning process as required by the manufacturer's installation instructions.
 - c. When cleaning holes for stainless steel anchors, use only stainless steel or non-metallic brushes.
- C. Insert and tighten (or torque) anchors in full compliance with the manufacturer's installation instructions.
 1. Once anchor is tightened (torque), do not attempt to loosen or remove its bolt or stud.
- D. Concrete anchors: Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Concrete Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum required member thickness
	In concrete	In grouted masonry	
3/8 inch	2 1/2 inch	2 5/8 inch	8 inch
1/2 inch	3 1/2 inch	3 1/2 inch	8 inch
5/8 inch	4 1/2 inch	4 1/2 inch	10 inch
3/4 inch	5 inch	5 1/4 inch	12 inch

E. Flush shell anchors:

1. Flush shell anchors are not permitted in the Work.
2. If equipment manufacturer's installation instructions recommend the use of flush shell anchors, contact Engineer for instructions before proceeding.

F. Sleeve anchors:

1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Sleeve Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In concrete	In grouted masonry	
M8 (1/2 inch)	70 mm (2 3/4 inch)	Not accepted	100 mm (8 inch)
M10 (5/8 inch)	76 mm (3 inch)	Not accepted	250 mm (10 inch)
M12 (3/4 inch)	80 mm (3 1/4 inch)	Not accepted	300 mm (12 inch)

2. Install with the sleeve fully engaged in the base material.

G. Screw anchors:

1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Screw Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In concrete	In grouted masonry	
3/8 inch	2 1/2 inch	3 1/4 inch	8 inch
1/2 inch	3 1/4 inch	4 1/2 inch	8 inch
5/8 inch	4 inch	5 inch	10 inch
3/4 inch	5 1/2 inch	6 1/4 inch	12 inch

2. Install screw anchors using equipment and methods recommended by the manufacturer. Continue driving into hole until the washer head is flush against the item being fastened.

H. Undercut concrete anchors:

1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Sleeve Anchors			
Nominal Diameter (bolt)	Minimum Effective Embedment Length		Minimum Member Thickness ¹
	In concrete	In grouted masonry	
M10 (3/8 inch)	100 mm (4 inch)	Not accepted	200 mm (8 inch)
M12 (1/2 inch)	125 mm (5 inch)	Not accepted	350 mm (14 inch)
M16 (5/8 inch)	190 mm (7 1/2 inch)	Not accepted	460 mm (18 inch)
M20 (7/8 inch)	250 mm (10 inch)	Not accepted	510 mm (20 inch)

Notes:
Thickness indicated is for pre-set units. If through-set units are accepted, obtain minimum member thickness requirements from the Engineer.

2. Installations of undercut anchors shall not be allowed where edge distances are less than 12 times the nominal diameter of the anchor stud.
3. Undercut bottom of hole using cutting tools manufactured for this purpose by the manufacturer of the undercut anchors being placed.

3.06 FIELD QUALITY CONTROL

- A. Contractor shall provide quality control over the Work of this Section as specified in Section 01460.
 1. Expenses associated with work described by the following paragraphs shall be paid by the Contractor.
- B. Post-installed anchors:
 1. Review anchor manufacturer's installation instructions and requirements of the Evaluation Service Report (hereafter referred to as "installation documents") for each anchor type and material.
 2. Observe hole-drilling and cleaning operations for conformance with the installation documents.
 3. Certify in writing to the Engineer that the depth and location of anchor holes, and the torque applied for setting the anchors conforms to the requirements of the installation documents.

3.07 FIELD QUALITY ASSURANCE

- A. Owner's Construction Coordinator/Plant Superintendent and Engineer's representative will provide on-site observation and field quality assurance for the Work of this Section.
 1. Expenses associated with work described by the following paragraphs shall be paid by the Contractor.
- B. Field inspections and special inspections (performed by Engineer's representative in coordination with Contractor):
 1. Required inspections: Observe construction for conformance to the approved Contract Documents, the accepted submittals, and manufacturer's installation instructions for the products used.

2. Record of inspections:
 - a. Maintain record of each inspection.
 - b. Submit copies to Owner upon request.
- C. Special inspections: Anchors cast into concrete and built into masonry.
1. Provide special inspection during positioning of anchors and placement of concrete or masonry (including mortar and grout) around the following anchors:
 - a. Anchor bolts.
 2. During placement, provide continuous special inspection at each anchor location to verify that the following elements of the installation conform to the requirements of the Contract Documents.
 - a. Anchor:
 - 1) Type and dimensions.
 - 2) Material: Type 316 stainless steel as specified in this Section or indicated on the Drawings.
 - 3) Positioning: Spacing, edge distances, effective embedment, and projection beyond the surface of the construction.
 - 4) Reinforcement at anchor: Presence, positioning, and size of additional reinforcement at anchors indicated on the Drawings.
 3. Following hardening and curing of the concrete or masonry surrounding the anchors, provide periodic special inspection to observe and confirm the following:
 - a. Base material (concrete or grouted masonry):
 - 1) Solid and dense concrete or grouted masonry material within required distances surrounding anchor.
 - 2) Material encapsulating embedment is dense and well-consolidated.
- D. Special Inspections: Post-installed mechanical anchors placed in hardened concrete and in grouted masonry.
1. Provide special inspection during installation of the following anchors:
 - a. Concrete anchors.
 2. Unless otherwise noted, provide periodic special inspection during positioning, drilling, placing, and torquing of anchors.
 - a. Provide continuous special inspection for post-installed anchors in “overhead installations” as defined in this Section.
 3. Requirements for periodic special inspection:
 - a. Verify items listed in the following paragraphs for conformance to the requirements of the Contract Documents and the Evaluation Report for the anchor being used. Observe the initial installation of each type and size of anchor, and subsequent installation of the same anchor at intervals of not more than 4 hours.
 - 1) Any change in the anchors used, in the personnel performing the installation, or in procedures used to install a given type of anchor, shall require a new “initial inspection.”
 - b. Substrate: Concrete or masonry surfaces receiving the anchor are sound and of a condition that will develop the anchor’s rated strength.
 - c. Anchor:
 - 1) Manufacturer, type, and dimensions (diameter and length).
 - 2) Material (Type 316 stainless steel).
 - d. Hole:
 - 1) Positioning: Spacing and edge distances.

- 2) Drill bit type and diameter.
 - 3) Diameter, and depth.
 - 4) Hole cleaned in accordance with manufacturer's required procedures. Confirm multiple repetitions of cleaning when recommended by the manufacturer.
 - 5) Anchor's minimum effective embedment.
 - 6) Anchor tightening/installation torque.
4. Requirements for continuous special inspection:
- a. The special inspector shall observe all aspects of anchor installation, except that holes may be drilled in his/her absence provided that he/she confirms the use of acceptable drill bits before drilling, and later confirms the diameter, depth, and cleaning of drilled holes.
- E. Field tests:
1. Owner's Construction Coordinator/Plant Superintendent may, at any time, request testing to confirm that materials being delivered and installed conform to the requirements of the Specifications.
 - a. If such additional testing shows that the materials do not conform to the specified requirements, the Contractor shall pay the costs of these tests.
 - b. If such additional testing shows that the materials do conform to the specified requirements, the Owner shall pay the costs of these tests.
 - 1) Anchors as specified in "non-conforming work."

3.08 NON-CONFORMING WORK.

- A. Remove miss-aligned or non-performing anchors.
- B. Fill empty anchor holes and repair failed anchor locations as specified in Section 03600 using high-strength, non-shrink, non-metallic grout.
- C. If more than 10 percent of all tested anchors of a given diameter and type fail to achieve their specified torque or proof load, the Engineer will provide directions for required modifications. Make such modifications, up to and including replacement of all anchors, at no additional cost to the Owner.

3.09 SCHEDULES

- A. Stainless steel. Provide and install stainless steel anchors at the following locations.
 1. "Corrosive locations" as defined in this Section: Type 316 stainless steel
 2. "Wet and moist locations" as defined in this Section: Type 316 stainless steel.
 3. "Other locations."
 - a. For connecting aluminum members to concrete
 4. At locations indicated on the Drawings.

Table – Required Anchoring Materials by Location.		
Location / Exposure	Materials	Notes
1. Anchors into concrete and grouted masonry for attachment of carbon steel , including structural steel and other steel fabrications:		
a) Interior dry areas:	Stainless steel 316.	
b) Locations with galvanized steel structures or fabrications:	Stainless steel 316.	1
c) Exterior and interior wet and moist locations:	Stainless steel – Type 316	1
d) Corrosive locations:	Stainless steel – Type 316	1
2. Anchors into concrete and grouted masonry for attachment of aluminum, stainless steel, or fiber-reinforced plastic (FRP) shapes and fabrications.		
a) Interior dry areas:	Stainless steel – Type 316.	1
b) Exterior and interior wet and moist locations:	Stainless steel – Type 316.	1
c) Corrosive locations:	Stainless steel – Type 316.	1
3. Anchors for attaching equipment and its appurtenances		
a) All locations	Stainless steel – Type 316	1
<u>Notes:</u> (1) Where anchors are in contact with a metal that differs from that of the anchor, provide isolation sleeves and washers.		

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
1. Aluminum grating stair tread.
 2. Aluminum stair nosing.
 3. Cast iron stop plank grooves.
 4. Concrete inserts.
 5. Handrails and guardrails.
 6. Ladders.
 7. Manhole frames and covers.
 8. Metal gratings.
 9. Metal tread plate.
 10. Preformed channel pipe supports.
 11. Stairs.
 12. Miscellaneous metals.
 13. Associated accessories to the above items.
- B. Related sections:
1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 09960 - High Performance Coatings.
 - b. Section 15061 - Pipe Supports.

1.02 REFERENCES

- A. Aluminum Association (AA):
1. DAF-45: Designations from Start to Finish.
 - a. M12-C22-A41.
- B. American Association of State Highway and Transportation Officials (AASHTO):
1. Standard Specifications for Highway Bridges.
- C. ASTM International (ASTM):
1. A 36 - Standard Specification for Carbon Structural Steel.
 2. A 48 - Standard Specification for Gray Iron Castings.
 3. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.

4. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels for General Applications.
6. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
7. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
8. A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
9. A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
10. A 489 - Standard Specification for Carbon Steel Lifting Eyes.
11. A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength.
12. A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. A 635 - 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.
15. A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
16. A 992 - Standard Specification for Structural Steel Shapes.
17. B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
18. B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
19. B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
20. B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
21. F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

D. American Welding Society (AWS):

1. A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

E. Occupational Safety and Health Administration (OSHA).

1.03 DEFINITIONS

- A. Passivation: Removal of exogenous iron or iron compounds from the surface of a stainless steel by means of chemical dissolution resulting from treatment with an acid solution that removes the surface contamination but does not significantly affect the stainless steel itself.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Aluminum grating stair tread.
 - 2. Aluminum stair nosing.
 - 3. Cast iron stop plank grooves.
 - 4. Handrail and guardrail.
 - 5. Manhole frames and covers.
 - 6. Metal grating.

- B. Shop drawings:
 - 1. Handrails and guardrails:
 - a. Including details on connection attachments, gates, kick plates, ladders, and angles.
 - b. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
 - c. Include erection drawings, elevations, and details where applicable.
 - d. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Ladders.
 - 3. Metal grating.
 - 4. Metal tread plate.
 - 5. Stairs.
 - 6. Miscellaneous metals.

- C. Samples:
 - 1. Guardrails with specified finishes.

- D. Quality control submittals:
 - 1. Design data.
 - 2. Test reports:
 - a. Guardrails: 3 copies of certified tests performed by an independent testing laboratory certifying that guardrails meet current State and OSHA strength requirements.
 - b. Gratings:
 - 1) Grating manufacturers' calculations showing that gratings will meet specified design load, stress, and deflection requirements for each size grating for each span.
 - 2) Reports of tests performed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Unless otherwise specified or indicated on the Drawings, structural and miscellaneous metals in accordance with the standards of the ASTM, including the following:

Item	ASTM Standard No.	Class, Grade Type or Alloy No.
Cast Iron		
Cast Iron	A 48	Class 40B
Steel		
Galvanized sheet iron or steel	A 653	Coating G90
Coil (plate)	A 635	--
Structural plate, bars, rolled shapes, and miscellaneous items (except W shapes).	A 36	--
Rolled W shapes	A 992	Grade 50
Standard bolts, nuts, and washers	A 307	--
High strength bolts, nuts, and hardened flat washers	A 325 A 490	--
Eyebolts	A 489	Type 1
Tubing, cold-formed	A 500	--
Tubing, hot-formed	A 501	--
Steel pipe	A 53	Grade B
Stainless Steel		
Plate, sheet, and strip	A 240	Type 304* or 316**
Bars and shapes	A 276	Type 304* or 316**
Bolts (Type 304)	F593	Group 1 Condition CW
Bolts (Type 316)	F593	Group 2 Condition CW
Aluminum		
Flashing sheet aluminum	B 209	Alloy 5005-H14, 0.032 inches minimum thickness
Structural sheet aluminum-	B 209	Alloy 6061-T6
Structural aluminum	B 209 B 308	Alloy 6061-T6
Extruded aluminum	B 221	Alloy 6063-T42
* Use Type 304L if material will be welded.		
** Use Type 316L if material will be welded.		

1. Stainless steels are designated by type or series defined by ASTM.
2. Where stainless steel is welded, use low-carbon stainless steel.

2.02 MANUFACTURED UNITS

- A. Aluminum grating stair tread:
 - 1. Manufacturers: One of the following or equal:
 - a. IKG Borden Industries, Aluminum Grating Stair Tread with Mebac nosing.
 - b. McNichols Co., Type A-Standard with Corrugated Angle Nosing.
 - 2. Material: Welded aluminum grating tread with non-slip nosing and integral end plates for bolt on attachment to stair stringers
 - 3. Size:
 - a. Tread width: To equal tread spacing plus 1 inch minimum.
 - b. Tread length: Length to suit stringer-to-stringer dimension indicated on the Drawings.
 - c. Depth: 1-3/4 inches.
 - 4. Bolts: Type 316 stainless steel.

- B. Aluminum stair nosing:
 - 1. Manufacturers: One of the following or equal:
 - a. Wooster Products, Inc., Type 101 Nosing.
 - b. American Safety Tread Co., Inc., Style 801 Nosing.
 - 2. Material: Cast aluminum abrasive nosings with aluminum oxide granules integrally cast into metal, forming permanent, nonslip, long-wearing surface.
 - 3. For installation in cast-in-place stairs.
 - 4. Configuration: 4 inches wide, fabricated with integrally cast stainless steel anchors at approximately 12-inch centers. Length to extend within 3 inches of stair edge on each side.

- C. Cast iron stop plank grooves:
 - 1. Manufacturers: One of the following or equal:
 - a. Neenah Foundry Company, R-7500 Series, Type A.
 - b. McKinley Iron Works, Type L.
 - 2. Size: 2-inch wide groove opening by 1-1/2 inch deep, unless otherwise indicated on the Drawings.
 - 3. Recess groove with the cast iron surface of the groove set flush with the concrete surface.

- D. Concrete inserts:
 - 1. Concrete inserts for supporting pipe and other applications are specified in Section 15061.

- E. Handrails and guardrails:
 - 1. General:
 - a. Design and fabricate assemblies to conform to current local, State, and OSHA standards and requirements.
 - b. Coordinate layout of assemblies and post spacings to avoid conflicts with equipment and equipment operators.
 - 1) Indicate on the shop drawings locations of such equipment.
 - 2) Highlight locations where railings cannot be made continuous, and obtain Engineer's directions on how to proceed before fabricating or installing railings.
 - 2. Aluminum handrails and guardrails (nonwelded pipe):
 - a. Rails, posts, and fitting-assembly spacers:

- 1) In accordance with ASTM B 429, 6005, 6063, or 6105, minimum Schedule 40, extruded aluminum pipe of minimum 1.89-inch outside diameter and 0.14-inch wall thickness.
 - b. Kick plates: 6061 or 6105 aluminum alloy.
 - c. Fastenings and fasteners: As recommended or furnished by the manufacturer.
 - d. Other parts: 6063 extruded aluminum, or F214 or F514.0 aluminum castings:
 - 1) Fabrications: In accordance with ASTM B 209 or ASTM B 221 extruded bars:
 - a) Bases: 6061 or 6063 extruded aluminum alloy.
 - 2) Plug screws or blind rivets: Type 305 stainless steel.
 - a) Other parts: Type 300 series stainless steel.
 - e. Finish of aluminum components:
 - 1) Anodized finish, 0.7 mil thick, applied to exposed surfaces after cutting. Aluminum Association Specification M12-C22-A41, mechanical finish non specular as fabricated, chemical finish-medium matte, anodic coating-clear Class I Architectural.
 - 2) Pretreat aluminum for cleaning and removing markings before anodizing.
 - f. Fabrication and assembly:
 - 1) Fabricate posts in single, unspliced pipe length.
 - 2) Perform without welding.
 - 3) Do not epoxy bond the parts.
 - 4) Maximum clear opening between assembled railing components as indicated on the Drawings.
 - g. Manufacturers: One of the following or equal:
 - 1) Moultrie Manufacturing Company, Wesrail.
 - 2) Golden Railings, Golden, CO, Riveted System.
 - 3) Craneveyor Corporation Enerco Metals, C-V Rail.
3. Guardrail gates:
- a. Supplied by guardrail manufacturer:
 - 1) Of same material, quality, and workmanship as specified for guardrail system in which they will be installed.
 - 2) Of design similar to that of handrail or railing system in which they will be installed.
 - b. Components: Gate frame, stainless steel self-closing device, hinges, gate stops, and durable self-locking type latch. Fabricate components in conformance with OSHA minimum strength requirements.
4. Fastenings and fasteners: As recommended or furnished by guardrail manufacturer for use with this system.

F. Ladders:

1. General:
 - a. Type: Safety type conforming to local, State, and OSHA standards as minimum. Furnish guards for ladder wells.
 - b. Size: 18 inches wide between side rails of length, size, shape, detail, and location indicated on the Drawings.
2. Aluminum ladders:
 - a. Materials: 6063-T5 aluminum alloy.

- b. Rungs:
 - 1) 1-inch minimum solid square bar with 1/8-inch grooves in top and deeply serrated on all sides.
 - 2) Capable of withstanding 1,000 pound load without failure.
- c. Side rails: Minimum 4-inch by 1/2-inch flat bars.
- d. Finish of aluminum components:
 - 1) Anodized finish, 0.7 mil thick, applied to exposed surfaces after cutting. Aluminum Association Specification M12-C22-A41, mechanical finish non specular as fabricated, chemical finish-medium matte, anodic coating-clear Class I Architectural.
 - 2) Pretreat aluminum for cleaning and removing markings before anodizing.
- e. Fabrication:
 - 1) Welded construction, of size, shape, location, and details indicated on the Drawings.
 - 2) For ladders over 20 feet high, furnish standard ladder cages or fall prevention system designed in accordance with State and OSHA requirements.
- f. Fall prevention system: Include but not limit to railing, brackets, clamps, 2 sleeves, and 2 belts, satisfying OSHA safe climbing requirements:
 - 1) Manufacturers: One of the following or equal:
 - a) North Consumer Products, Saf-T-Climb.
 - b) Swager Communications, Climbers Buddy System.

G. Manhole frames and covers:

- 1. Material: Gray iron castings, in accordance with ASTM A 48, Class 30-B.
- 2. Type: Heavy-duty traffic type, with combined minimum set weight of 265 pounds.
- 3. Machine horizontal and vertical bearing surfaces to fit neatly, with easily removable cover bearing firmly in frame without rocking.
- 4. Frame:
 - a. Bottom flange type.
 - b. Approximately 4-1/2 inches frame height.
 - c. Dimensions as indicated on the Drawings.
 - 1) Minimum inside clear dimension may not be smaller than nominal diameter minus 2 inches.
- 5. Cover:
 - a. Skid-resistant grid pattern design stamped with name of utility service provided by manhole, such as "ELECTRICAL," "SEWER," "TELEPHONE," or "REUSE WATER."
 - b. Solid type without ventilation holes.
- 6. Finish: Unpainted.

H. Metal gratings:

- 1. General:
 - a. Fabricate grating to cover areas indicated on the Drawings.
 - b. Unless otherwise indicated on the Drawings, grating over an opening shall cover entire opening.
 - c. Make cutouts in grating where required for equipment access or protrusion, including valve operators or stems, and gate frames.
 - d. Band ends of grating and edges of cutouts in grating:

- 1) End banding: 1/4 inch less than height of grating, with top of grating and top edge of banding flush.
 - 2) Cutout banding: Full-height of grating.
 - 3) Use banding of same material as grating.
 - 4) Panel layout: Enable installation and subsequent removal of grating around protrusions or piping.
 - 5) Openings 6 inches and larger: Lay out grating panels with edges of 2 adjacent panels located on centerline of opening.
 - 6) Openings smaller than 6 inches: Locate opening at edge of single panel.
 - 7) Where an area requires more than 1 grating section to cover area, clamp adjacent grating sections together at 1/4-points with fasteners acceptable to Engineer.
 - 8) Fabricate steel grating sections in units weighing not more than 50 pounds each.
 - 9) Fabricate aluminum grating sections in units of weighing not more than 50 pounds each.
- e. When requested by Engineer, test 1 section of each size grating for each span length involved on the job under full load:
 - 1) Furnish a suitable dial gauge for measuring deflections.
 - f. Grating shall be aluminum, unless otherwise specified or indicated on the Drawings.
2. Aluminum grating:
 - a. Material for gratings, shelf angles, and rebates: 6061-T6 or 6063-T6 aluminum alloy, except crossbars may be 6063-T5 aluminum alloy.
 - b. Shelf angle concrete anchors: Type 304 or Type 316 stainless steel.
 - c. Grating rebate rod anchors: 6061-T6 or 6063-T6 aluminum alloy.
 - d. Bar size and spacing: As determined by manufacturer to enable grating to support design load.
 - e. Design live load: A minimum of 100 pounds per square foot uniform live load on entire grating area, but not less than the live load indicated on the Drawings for the area where grating is located.
 - f. Maximum fiber stress for design load: 12,000 pounds per square inch.
 - g. Maximum deflection due to design load: 1/240 of grating clear span.
 - h. Maximum spacing of main grating bars: 1-1/8 inches clear between bars.
 - i. Minimum grating height: 1-1/2 inches.
 - j. Manufacturers: One of the following or equal:
 - 1) IKG Borden Industries, grooved aluminum I-bar.
 - 2) Brodhead Steel Products, Inc., grooved aluminum I-bar.
 3. Aluminum grating planks:
 - a. Materials: Meet requirements previously specified for aluminum grating.
 - b. Fabrication:
 - 1) Meet requirements previously specified for aluminum grating.
 - c. Have unpunched surface with cross hatched anti-skid surface.
 - d. Minimum weight of 3-1/4 pounds per square foot.
 - e. Provide 1 inch diameter hole with smooth edges at each end for each plank.
 - f. Furnish planks in 2 foot widths.
 - g. Manufacturers: One of the following or equal:
 - 1) IKG, Heavy Duty Aluminum Plank Grating HD-P.

- a) If degreasing is required before cleaning to remove scale or iron oxide, cleaning (pickling) treatments with citric acid are permissible; however, these treatments shall be followed by inorganic cleaners such as nitric-hydrofluoric acid.
 - 2) Provide acid descaling (pickling) in accordance with Table A1.1 of Annex A1 of ASTM A 380.
 - 3) After pickling, final cleaning of stainless steel shall conform to Part II of Table A2.1 of Annex A2 of ASTM A 380.
 - e. After cleaning, inspect using methods specified for "gross inspection" in ASTM A 380.
 - f. Improperly or poorly cleaned and passivated materials shall not be shipped and will not be accepted at the job site.
- N. Miscellaneous structural steel:
- 1. Provide miscellaneous steel items not specified in this Section as indicated on the Drawings or specified elsewhere.
 - a. Fabricate and install in accordance with the best practices of the trade.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of conditions:
- 1. Examine work in place to verify that it is satisfactory to receive the work of this Section.
 - 2. If unsatisfactory conditions exist, do not begin this work until such conditions have been corrected.

3.02 INSTALLATION

- A. General: Install products as indicated on the Drawings, and in accordance with shop drawings and manufacturer's printed instructions, as applicable except where specified otherwise.
- B. Aluminum stair nosing:
- 1. Install stair nosings on treads of concrete stairs, including top tread on upper concrete slab.
 - 2. Omit stair nosings where concrete is submerged.
 - 3. Coat aluminum surfaces in contact with concrete as specified in Section 09960.
 - 4. Cast stair nosings in fresh concrete, flush with tread and riser faces. Install nosing in center of step approximately 3 inches from each stair edge.
- C. Cast iron stop plank grooves:
- 1. Recess stop plank grooves with cast iron surfaces of groove set flush with concrete surface.
- D. Handrails and guardrails:
- 1. General:
 - a. Fasten pipe rails to fittings with Series 300 stainless steel pop rivets or flush set screws.

- b. Make pipe cuts clean and straight, free of burrs and nicks, and square and accurate for minimum joint-gap.
 - c. Drill and countersink holes to proper size, as required for a tight flush fit of screws and other component parts.
 - d. Space attachment brackets as indicated in the manufacturer's instructions.
2. Aluminum pipe handrails and guardrails:
- a. During construction, keep exterior surfaces of handrails and guardrails covered with 0.4 millimeters, minimum, heat shrink polyethylene film.
 - b. Do not remove protective film before handrails and guardrails have been accepted by Engineer nor before other work in proximity of handrails and guardrails has been completed.
 - c. Discontinue handrails and guardrails at lighting fixtures.
 - d. Provide 1/8-inch diameter weep hole at base of each post.
 - e. Where protection is applied for prevention of dissimilar materials electrolysis, make application such that none of the protective material is visible in the completed assembly.
 - f. Space posts as indicated on the Drawings.
 - g. Anchor posts into concrete by grouting posts into formed holes in concrete, into stainless steel sleeves cast in concrete; or bracket mount to face of concrete surfaces as specified and indicated on the Drawings.
 - h. Space rails as indicated on the Drawings.
 - i. Make adequate provision for expansion and contraction of kick plates and rails.
 - 1) Make provisions for removable sections where indicated on the Drawings.
 - j. Make lower rails a single, unspliced length between posts, or continuous.
 - k. Make top rails continuous whenever possible, and attach single, unspliced lengths to 3 posts minimum.
 - l. Draw up fasteners tight with hand wrench or screw driver.
 - m. Space attachment brackets as indicated on shop drawings or in manufacturer's installation instructions.
 - n. Completed installation shall have handrails and railings rigid and free of play at joints and attachments.
 - o. Protect handrail and guardrail finish from scratches, gouges, dents, stains, and other damage.
 - p. Replace damaged or disfigured handrails and guardrails with new.
 - q. Shortly before final acceptance of the work, and after removal of protective polyethylene film, clean handrails and guardrails with mild detergent or with soap and water.
 - 1) After cleaning, thoroughly rinse handrails and guardrails and wipe with soft cloth.
 - r. Erect guardrail straight, level, plumb, and true to the positions as indicated on the Drawings. Correct deviations from true line of grade, which are visible to the eye.
3. Guardrail gates:
- a. Install gate to be a vertical plane with the guardrail when in the closed position.
 - b. Install hinges so that each gate can swing 180 degrees from the closed position to the fully open position.
 - c. Install so that the gates swing to the walkway side of the guardrail only.

- 1) Install gate stops on the stationary railing posts to prohibit gates from swinging in the wrong direction.
- d. Install gate frames, hinges, stops, and latches in conformance with OSHA minimum strength requirements.

E. Ladders:

1. Secure to supporting surface with bent plate clips providing minimum 8 inches between supporting surface and center of rungs.
2. Where exit from ladder is forward over top rung, extend side rails 3 feet 3 inches minimum above landing, and return the rails with a radius bend to the landing.
3. Where exit from ladder is to side, extend ladder 5 feet 6 inches minimum above landing and rigidly secure at top.
4. Erect rail straight, level, plumb, and true to position indicated on the Drawings.
 - a. Correct deviations from true line or grade which are visible to the eye.

F. Manhole frames and covers:

1. Installation.

G. Metal gratings:

1. General:
 - a. Allow 1/8-inch maximum clearance between ends of grating and inside face of vertical leg of shelf angles.
 - b. Horizontal bearing leg of shelf angles shall be 2 inches minimum.
 - c. Install aluminum plate or angles where necessary to fill openings at changes in elevation and at openings between equipment and grating.
 - d. Install angle stops at ends of grating.
 - e. Installed grating shall not slide out of rebate or off support.
 - f. Weld stops in place, unless otherwise specified or indicated on the Drawings.
 - g. Top surfaces of grating sections adjacent to each other shall lie in same plane.
2. Aluminum grating:
 - a. Coat surfaces of aluminum shelf angles, rebates, and rod anchors in contact with concrete as specified in Section 09960.
 - b. Aluminum grating: Support on aluminum shelf angles or rebates.
3. Aluminum grating planks:
 - a. Support and install planks as specified for aluminum grating.
4. Steel grating:
 - a. Support on hot-dip galvanized structural steel shelf angles or rebates.
5. Heavy-duty steel grating:
 - a. Support on hot-dip galvanized structural steel rebates embedded and anchored in concrete.
 - b. Use for roadways, traffic areas, and where indicated on the Drawings.

H. Stairs:

1. General:
 - a. Install guard railings around stair wells as indicated on the Drawings or specified.

I. Stainless Steel

1. Welding.

- a. Passivate field-welded surfaces.
 - 1) Provide cleaning, pickling, and passivating as specified in this Section.
 - 2) Clean using Derustit Stainless Steel Cleaner, or equal.

END OF SECTION

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SECTION 07900

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Acrylic-Latex sealant.
 - 2. Precast concrete joint sealant.
 - 3. Silicone sealant.
 - 4. Synthetic rubber sealing compound.
 - 5. Synthetic sponge rubber filler.
 - 6. Related materials.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. M 198 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- B. ASTM International (ASTM):
 - 1. C 920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. C 990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - 3. D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - 4. D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

1.03 SUBMITTALS

- A. Product data.
- B. Samples, include color selections.
- C. Manufacturer's Installation Instructions.
- D. Warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer qualifications: Manufacturer of proposed product for minimum 5 years with satisfactory performance record.
- B. Installer qualifications: Manufacturer approved installer of products similar to specified products on minimum 5 projects of similar scope as Project with satisfactory performance record.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental requirements: Do not apply sealant on wet or frosty surfaces or when surface temperature is higher than 100 degrees Fahrenheit or lower than recommended by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products in accordance with manufacturer's recommendations.
- B. Code date packages. Do not use material older than manufacturer's published shelf life. Store materials at temperatures lower than 80 degrees Fahrenheit. Condition materials in accordance with manufacturer's instructions prior to installation.

1.07 SEQUENCING AND SCHEDULING

- A. Caulk joints prior to painting.

1.08 WARRANTY

- A. Warrant to correct defective products for minimum 1 year in accordance with manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 ACRYLIC-LATEX SEALANT

- A. Permanently flexible, nonstaining, and nonbleeding latex modified acrylic sealant compound, colors as selected by Engineer from manufacturer's standard options. Manufacturers: One of the following or equal:
 1. Tremco, Tremflex 834.
 2. Pecora Corp., Number AC-20.
 3. Sonneborn, Sonolac.

2.02 PRECAST CONCRETE JOINT SEALANT

- A. Preformed, cold-applied, ready-to-use, flexible joint sealant in accordance with ASTM C 990 and AASHTO M 198. Manufacturers: One of the following or equal.
 1. Henry Corporation, Ram-Nek.
 2. Concrete Sealants Division, ConSeal.

2.03 SILICONE SEALANT

- A. ASTM C 920, Type S, Grade NS, Class 25, single component silicone sealant. Manufacturers: One of the following or equal:
 1. Tremco, Proglaze.
 2. Pecora Corp., Number 864.
 3. Dow Corning, Number 795.
 4. General Electric, Number 1200 Series.

2.04 SYNTHETIC RUBBER SEALING COMPOUND

- A. Manufacturer: One of the following or equal:
 - 1. Sika Corporation, Lyndhurst, NJ, Sikaflex 2c NS or SL.
 - 2. Polymeric Systems, Inc., PSI 275.
 - 3. Pacific Polymers, Garden Grove, CA, Elastothane 227R.

- B. Material: In accordance with ASTM C 920 Type M, Grade P (pourable), Class 25 and Type M, Grade NS (non-sag), Class 25; multi-part polyurethane; able to cure at room temperature to firm, highly resilient polymer; able to perform satisfactory when continuously submerged in water or sewage and exposed to direct sunlight in dry condition; with the following properties determined at 75 degrees Fahrenheit and 50 percent relative humidity:
 - 1. Base: Polyurethane rubber.
 - 2. Solids: Minimum 97 percent.
 - 3. Application time: Minimum 2 hours.
 - 4. Cure time: Maximum 3 days.
 - 5. Tack free time: 24 hours.
 - 6. Ultimate hardness: Non-sag 25, Pourable/SL 40, within 5 Shore A.
 - 7. Tensile strength: Non-sag 120 pounds per square inch minimum and self-leveling minimum 170 pounds per square inch when tested in accordance with ASTM D 412.
 - 8. Ultimate elongation: Minimum 490 percent when tested in accordance with ASTM D 412.
 - 9. Tear resistance: Non-sag 45 pounds per inch minimum and self-leveling minimum 85 pounds per inch when tested in accordance with ASTM D 624, Die C.
 - 10. Service temperature range: Minus 25 degrees to 158 degrees Fahrenheit.

- C. Color: Gray to match concrete, unless indicated on the Drawings.

2.05 SYNTHETIC SPONGE RUBBER FILLER

- A. Closed-cell expanded sponge rubber manufactured from synthetic polymer neoprene base, or resilient polyethylene foam backer rod. Manufacturers: One of the following or equal:
 - 1. Presstite, Number 750.3 Ropax Rod Stock.
 - 2. Rubatex Corp., Rubatex-Cord.

- B. Characteristics:
 - 1. Suitable for application intended.
 - 2. Strength: As necessary for supporting sealing compound during application.
 - 3. Resiliency: Sufficient resiliency to prevent significant load transfer across joint.
 - 4. Resistance to environmental conditions of installation.
 - 5. Bonding: No bonding to the sealing compound.
 - 6. Structure: Cellular, prevents wicking or absorption of water.
 - 7. Compatibility with other materials in joint and acceptance by manufacturer of sealing compound.
 - 8. Size: Minimum 25 percent greater than nominal joint width.

2.06 RELATED MATERIALS

- A. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.

- B. Joint cleaner: Noncorrosive, nonstaining, compatible with joint forming materials and as recommended by sealant manufacturer.
- C. Bond breaker tape: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify acceptability of joint dimensions, physical, and environmental conditions.
- B. Verify that surfaces are dry, clean, and free of dirt, grease, curing compound, and other residue which might interfere with adhesion of sealants.

3.02 PREPARATION

- A. Allow concrete to cure thoroughly before caulking.
- B. Synthetic sponge rubber filler:
 - 1. Prepare surfaces designated to receive filler in accordance with manufacturer's installation instructions.
 - 2. Do not stretch filler beyond its normal length during installation.
- C. Caulking:
 - 1. Verify that surfaces are dry, clean, and free of dirt, grease, curing compounds, and other residue that might interfere with adhesion of sealant.
 - 2. Concrete, masonry, wood, and steel surfaces: Clean and prime in accordance with manufacturer's instructions prior to caulking.
- D. Synthetic rubber sealing compound:
 - 1. Ensure surfaces to which synthetic rubber must bond are dry and free of dust, dirt, and other foreign residue.
 - 2. Heavy sandblasted caulking groove to sound surface, and prime with manufacturer's recommended primer for particular surface.
- E. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but neither more than 5/8 inches deep nor less than 3/8 inches deep.
- F. For normal moving building joints sealed with elastomeric sealants not subject to traffic, fill joints to depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
- G. For joints sealed with acrylic-latex sealants, fill joints to depth in range of 75 percent to 125 percent of joint width.
- H. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- I. Prepare surfaces and install synthetic sponge rubber filler in accordance with manufacturer's recommendations.

- J. Do not stretch filler beyond normal length during installation.
- K. Apply bond breaker when recommended by joint sealer manufacturer.

3.03 INSTALLATION

- A. Synthetic sponge rubber filler: Install filler in accordance with manufacturer's installation instructions.
- B. Caulking, joints, and sealing:
 - 1. Construct expansion, contraction, and construction joints as indicated on the Drawings.
 - 2. Install pipe and conduit in structures as indicated on the Drawings.
 - 3. Caulk doors, windows, louvers, and other items installed in or over concrete openings inside and out.
 - 4. Use synthetic rubber sealing compound for caulking where indicated on the Drawings or as specified, except for masonry construction and where specified otherwise.
 - 5. Complete caulking prior to painting.
 - 6. Verify that concrete is thoroughly cured prior to caulking.
 - 7. When filler compressible material is used, use untreated type.
 - 8. Apply caulking with pneumatic caulking gun.
 - 9. Use nozzles of proper shape and size for application intended.
 - 10. Maintain continuous bond between caulking and sides of joint to eliminate gaps, bubbles, or voids and fill joint in continuous operation without layering of compound.
 - 11. Employ experienced applicators to caulk joints and seams in neat workmanlike manner.
 - 12. To hasten curing of compound when used on wide joints subject to movement, apply heat with infrared lamps or other convenient means.
 - 13. Apply synthetic rubber sealing compound with pneumatic caulking tool or other acceptable method.

3.04 CLEANING

- A. Clean surfaces adjacent to sealant as work progresses.
- B. Remove excess uncured sealant by soaking and scrubbing with sealant cleaning solvent.
- C. Remove excess cured sealant by sanding with Number 80 grit sandpaper.
- D. Leave finished work in neat, clean condition.

3.05 SCHEDULE

- A. Acrylic latex:
 - 1. Use where indicated on the Drawings.
 - 2. Interior joints with movement less than 7.5 percent and not subject to wet conditions.
- B. Silicone:
 - 1. Use where indicated on the Drawings.

2. Joints and recesses formed where window, door, louver and vent frames, and sill adjoin masonry, concrete, stucco, or metal surfaces.
 3. Door threshold bedding.
 4. Moist or wet locations, including joints around plumbing fixtures.
 5. Stainless steel doors and frames, including joints between applied stops and frames, and around anchor bolts.
 6. Plenum joints.
- C. Synthetic rubber sealing compound, non-sag Type II:
1. Use where indicated on the Drawings.
 2. Water-bearing and earth-bearing concrete structures.
 3. Joints in masonry, concrete vertical surfaces, and metal-faced panels in vertical surfaces.
 4. Joints between sheet metal flashing and trim.
 5. Joints between sheet metal flashing and trim, and vertical wall surfaces.
 6. Small voids between materials requiring filling for weathertight performance in vertical surfaces.
 7. Perimeters of frames of doors, windows, louvers, and other openings where bonding is critical to airtight performance.
 8. Expansion and control joints in masonry vertical surfaces.
- D. Synthetic rubber sealing compound, self-leveling Type I:
1. Use where indicated on the Drawings.
 2. Expansion and control joints in masonry, concrete horizontal surfaces, and metal panels in horizontal surfaces.
 3. Small voids between materials requiring filling for weathertight performance in horizontal surfaces.
 4. Pavement joints.
 5. Perimeters of frames of doors, windows, louvers, and other openings in horizontal surfaces where bonding is critical to airtight performance.

END OF SECTION

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. This Section specifies aluminum exterior doors and frames.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 sections apply to this Section.
- B. Related work in other Sections:
 - 1. Section 03300 - Cast-In-Place Concrete.
 - 2. Section 07900 - Joint Sealants.
 - 3. Section 08710 - Door Hardware.
 - 4. Section 09910 – Painting.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. FBC, Florida Building Code, (5th Edition) 2014.
 - 2. ADAAG, American with Disabilities Act Accessibility Guidelines.
 - 3. NFPA 101, Life Safety Code.
 - 4. NFPA 80, Standard for Fire Doors and Fire Windows.
- B. Use skilled workmen who are trained and experienced and who are familiar with the installation of the products specified herein.

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract:
 - 1. Product data including Manufacturer's literature demonstrating compliance with these specifications.
 - 2. Shop drawings showing the specifications and construction details of all components of the doors and frames. Include details of each frame type, elevations of door design types, gauges and joints. Shop drawings shall show details of anchoring of frames to the structure.
 - 3. Schedule of doors and frames using the same reference numbers as the Drawings.
 - 4. If required by the building jurisdiction, provide calculations for the connection details compiled by a registered structural engineer.
 - 5. If required by the building jurisdiction, provide product approvals.

1.05 WARRANTY

- A. Provide a written warranty that all work under this section will be free from defects of materials and workmanship for a period of two years upon acceptance by the Owner, except that frame reinforcement for hinges shall be warranted for the life of the building.

1.06 PRODUCT HANDLING

- A. Comply with pertinent provisions of Division 1.

PART 2 PRODUCTS

2.01 ALUMINUM DOORS

- A. Doors shall meet the following criteria:
 - 1. Face sheet shall be smooth 0.040" aluminum sheet, 5005-H14 alloy, laminated to 0.125" tempered hardboard.
 - 2. Core material shall be ISO-25 polyisocyanurate foam, closed cell, with a minimum density of 2.0 lbs. / cu. ft.
 - 3. Door rails shall be square edge, aluminum extrusion 6063-T5 alloy.
 - 4. Doors shall be equal to Cline Series 100BE.

2.02 ALUMINUM FRAMES

- A. Frames shall meet the following criteria:
 - 1. Extruded aluminum alloy 6063-T5 with minimum wall thickness of 0.125".
 - 2. Frame dimensions shall be as shown on the drawings.
 - 3. Corners shall be cut square and fastened using concealed stainless steel screws.
 - 4. Reinforce frame for hinges.

2.03 FINISH

- A. Doors and frames to be finished as follows:
 - 1. Anodized in accordance with Aluminum Association #MM12C22A31, Class II, dark bronze.

2.04 ACCEPTABLE MANUFACTURERS

- A. Cline Aluminum Doors, Inc.
- B. Any other manufacturer who can demonstrate compliance with this specification.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas where the doors and frames will be installed and bring any unsatisfactory conditions to the attention of the Contractor. Do not proceed with installation until the unsatisfactory conditions are corrected.

3.02 INSTALLATION

- A. Install the doors and frames at locations indicated on the drawings.
- B. Install all items in accordance with the manufacturer's recommendations.
- C. Coordinate as required with other trades prior to installation.

3.03 CLEANUP

- A. Clean up any loose material upon completion of installation.
- B. Clean doors, frames and all related items upon completion of installation and ensure that all items are in working condition.

END OF SECTION

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SECTION 08331

OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Aluminum overhead coiling doors for chain hoist operation.
- B. Provide operating door assemblies, door curtain, guides, hardware, operators, and installation of accessories.

1.03 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closes position. The door is then moved to the open position and back to the closed position.

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure) per drawings, acting inward and outward.
- B. Operation-Cycle Requirements: Design overhead coiling door components and operator to operate for not less than 20,000 cycles.
 - 1. Include tamperproof cycle counter.

1.05 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory include details of construction relative to materials, dimensions of individual components, profiles, and finishes in accordance with Section 01330. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.

- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
- C. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
 - 1. Curtain Slats: 12-inch length.
- D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer: Rolling doors shall be manufactured by a firm with a minimum of five years experience in the fabrication and installation of rolling doors.
- B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.
- C. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from the overhead coiling doors manufacturer.
- D. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Atlas Door Corp.; Div. of Clopay Building Products Co.
 - 2. The Cookson Company.
 - 3. Cornell Iron Works Inc.
 - 4. McKeon Rolling Steel Door Company, Inc.
 - 5. Overhead Door Corporation.
 - 6. Raynor Garage Doors.
 - 7. Wayne-Dalton Corp.
- B. Exterior Doors: Series 625 with F-265I slat, powder coat finish with color selected by Owner, by Overhead Door Corporation, or approved equal.

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Aluminum Door Curtain Slats: ASTM B 209 or ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - a. Provide slats equal to those specified above.
 - 2. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within aluminum slat faces.
 - 3. Inside Curtain Slat Face: To match material of outside metal curtain slat and as follows:
 - a. Aluminum Sheet Thickness: Same thickness as outside aluminum curtain face slat.
- B. Endlocks: Malleable-iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets, or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Windlocks: Malleable-iron castings secured to curtain slats with galvanized rivets or high-strength nylon, as required to comply with wind load.
- D. Bottom Bar: Consisting of 2 angles, each not less than 1-1/2 by 1/8 inch thick, aluminum extrusion to suit type of curtain slats.
 - 1. Astragal: provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior door.
- E. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than 3/16-inch thick galvanized steel sections complying with ASTM A 36, and guides to prevent overtravel of curtain and a continuous bar for holding windlocks.

2.03 HOODS AND ACCESSORIES

- A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as wetherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
 - 1. Fabricate aluminum hoods, complying with ASTM B 2019, alloy and temper recommended by aluminum doors. Hood to be painted to match curtain slats.
 - 2. Shape: Round.
 - 3. Exterior Mounted Door: Fabricate hood with sealant-joint bead profile for applying joint sealant.

- B. Weatherseals: provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and at top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch thick, replaceable, continuous sheet secured to inside of curtain coil hood.
 - 1. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch thick seals of flexible vinyl, rubber or neoprene at door jambs for a weathertight installation.
- C. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 inches high.
- D. Fabricated locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
 - 1. Locking Bars: Single-jamb side, operable from inside only.
 - 2. Provide Lock cylinder for electric operation with interlock switch.
- E. Chain Lock Keeper: Suitable for padlock.

2.04 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings of self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in. / ft. of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.05 MANUAL DOOR OPERATORS

- A. Chain Hoist Operator: Provide manual chain hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and geared reduction unit with a maximum 35-lb pull for door operation. Furnish alloy steel hand chain with chain holder secured to operator guide.

2.06 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 ALLUMINUM FINISHES

- A. Where surfaces are not to be painted provide manufacturer's standard anodized class I finish.

PART 3 EXECUTION

3.01 PREPARATION

- A. Coordination and Measurements: Measurements shall be taken at the building to assure proper erection of the work. Check all dimensions, whether or not shown on the Drawings, upon which the accurate fitting and installation of the door may depend, or which would affect the proper operation of the door.

3.02 INSTALLATION

- A. Install overhead coiling doors in accordance with the instructions and recommendations of the manufacturer and in such a manner that will prevent damage or deformation. Doors shall be stored at the job site before installation on platforms or pallets. During storage, doors shall be stored in a weathertight area, and shall be covered to protect the door from dust, dirt and damage.
- B. Doors shall be installed plumb, level and true to line in accordance with the details shown on the approved shop drawings. Hardware shall be applied and adjusted to achieve quiet and smooth operation.
- C. Install the doors securely in appropriate frames and adjusted for proper operation without sticking or binding.
- D. Install door and operating equipment complete with necessary hardware, jamb, and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with approved shop drawings, manufacturer's instructions, and as specified herein.
- E. Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for the entire perimeter.

3.03 PROTECTION

- A. Protect door installation from damage until the date of final acceptance. Damaged work shall be repaired or replaced to the satisfaction of the Owner and the Engineer at no additional cost to the Owner.

END OF SECTION

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SECTION 08710
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Door hardware.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 08120 - Aluminum Doors and Frames.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 2. E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- B. Builders Hardware Manufacturers Association (BHMA):
 - 1. A156.7 - Template Hinge Dimensions.
 - 2. A156.18 - Materials and Finishes.
- C. Underwriters Laboratories, Inc.

1.03 SUBMITTALS

- A. Product Data.
- B. Hardware schedule: Include references to Engineer's hardware group number, door type designations, locations, other pertinent data, and manufacturer names or suitable abbreviation opposite items scheduled.
- C. Samples: Include for each different type and manufacturer for review of finish.
- D. Construction key distribution list: Submit upon Owner's request.

- E. Templates:
 - 1. Furnish hardware templates to fabricators of doors, frames, and other work to be factory-prepared for hardware.
 - 2. Check shop drawings of other work to confirm that adequate hardware backing is available.
- F. Project record documents: Include corrected hardware schedule.

1.04 REGULATORY REQUIREMENTS

- A. Provide hardware for fire-resistive rated openings that complies with UL and listed by UL.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hardware where directed in unopened packages with items packed separately, complete and ready for installation with necessary fittings, trim, fasteners, and accessories.
- B. Provide packages bearing the manufacturers' labels with each item or group of items identified according to the accepted hardware schedule.

1.06 SCHEDULING AND SEQUENCING

- A. Upon receipt of accepted hardware schedule, coordinate accepted hardware schedule, templates, reinforcing units, and template instructions to door and frame sections.

PART 2 PRODUCTS

2.01 FASTENERS

- A. Types:
 - 1. To concrete, marble, or masonry: Machine screws and flush shells.
 - 2. To wood: Wood screws.
 - 3. On gypsum board or plaster: Screws of sufficient length to provide solid connection to framing or backing behind gypsum board or plaster.
 - 4. To mineral and hollow core doors: Sex bolts.
 - 5. Of exit devices to doors: Thru-bolts, unless otherwise specified.
- B. Screws, exposed: Phillips-head type, full-threaded screws, not combination type.
- C. Sizes: Suitable for heavy use.
- D. Finish: Stainless steel.

2.02 HINGES

- A. Manufacturers: One of the following or equal:
 - 1. Stanley.
 - 2. Hager.

3. McKinney.
 4. Ives.
- B. Material:
1. Interior doors in corrosive environments: Stainless steel.
 2. Exterior doors: Stainless steel.
- C. Knuckles, number of: Minimum 5.
- D. Ball bearings: Concealed with interior self-lubricating bushings.
- E. Type for doors with closers: Ball bearing.
- F. Material for fire-resistive rated doors: Steel.
- G. Pins for interior doors: Non-rising.
- H. Pins for exterior doors: Non-removable.
- I. Template hinges: BHMA A156.7.
- J. Tips: Flat button.
- K. Height: As follows, unless otherwise specified:
1. Doors 1-3/8-inch thick: 3-1/2 inches.
 2. Doors 1-3/4-inch thick and up to 41 inches wide: 4-1/2 inches.
 3. Doors 1-3/4-inch thick and from 41 to 48 inches wide: 4-1/2 inches, extra heavy.
 4. Doors 2 inches thick or over 48 inches wide: 5 inches, extra heavy.
- L. Widths: Sufficient to clear trim projection when door swings 180 degrees, unless otherwise specified.
- M. Number per door leaf: As follows, unless otherwise specified:
1. 3 hinges on door to 7 feet, 6 inches in height.
 2. 1 additional hinge for each additional 2 feet, 6 inches of height or fraction thereof.

2.03 LOCKSETS

- A. Manufacturers typical: One of the following or equal:
1. Schlage ND Series Rhodes design, non-keyed.
 2. Yale 4700 (LN) Series Augusta design, non-keyed.
- B. Cylinders:
1. Number of pins: Minimum 6.
 2. Cases: Steel, cylindrical.
 3. Interior parts: Non-corrosive with non-plastic, non-die-cast, non-aluminum mechanisms.
 4. Accessibility to key-in-knob type cylinders: Not requiring removal of lockset from door.
 5. Plugs: Extruded brass bar material fully round without flattened areas.

- C. Strikes:
 - 1. Material: Same as lock trim.
 - 2. Lock and latch boxes: Wrought.
 - 3. Lips: Extended, able to protect trim from marring by latch bolt.
 - 4. Cutouts at metal frames: In accordance with ANSI, unless otherwise specified.
- D. Levers: Type that returns to within 1/2 inch of door.
- E. Backset: 2-3/4 inches.
- F. Trim materials: As follows, unless otherwise specified:
 - 1. Typical: Stainless steel.
 - 2. Corrosive environments: Stainless steel.

2.04 PUSH/PULL PLATES

- A. Manufacturers: One of the following or equal:
 - 1. Ives.
 - 2. Trimco.
 - 3. Rockwood.
- B. Pulls:
 - 1. Material: As scheduled.
 - 2. Size: Minimum 8 inches center to center, minimum grip diameter of 3/4 inch, minimum projection of 2-1/4 inch.
- C. Pull plates:
 - 1. Material: As scheduled.
 - 2. Plate size: Minimum 3 by 12 inches by 0.050-inch thick, with beveled edges on 4 sides with pull.
 - 3. Pull size: Minimum 8 inches center to center, minimum grip diameter of 3/4 inch, minimum projection of 2-1/4 inch.
- D. Push plates:
 - 1. Material: As scheduled.
 - 2. Size: Minimum 3 by 12 inches by 0.050-inch thick, with beveled edges on 4 sides.

2.05 CLOSERS

- A. Manufacturers:
 - 1. Features:
 - a. Heavy-duty.
 - b. Non-handed and non-sized.
 - c. Adjustable spring power from size 1 through 4.
 - d.
 - 2. One of the following or equal:
 - a. Sargent, 351 Series.
 - b. LCN, Super Smoothee Model 4041 Series.
 - c. Norton Door Controls, Multi-Size Door Closers Model 7500BF Series.
- B. Type: Full rack and pinion type with steel spring and non-gumming, non-freezing hydraulic fluid.

- C. Controls: Separate set for regulating sweep speed, latch speed, backcheck and backcheck positioning, or where schedules, spring power.
- D. Sizes: As recommended by accepted manufacturer.
- E. Covers: Metal, capable of receiving finishes to match adjacent hardware finishes, unless otherwise specified.
- F. Narrow frame provisions: Drop plates.
- G. Effort to operate: As follows:
 - 1. Exterior: Maximum 8-1/2 pounds.
 - 2. Interior: Maximum 5 pounds.
 - 3. Fire-resistive rated doors: Maximum 15 pounds.
- H. Adjust closers in accordance with manufacturer's directions for size of door.

2.06 MISCELLANEOUS DOOR HARDWARE

- A. Wall stops: As scheduled.
 - 1. Manufacturers: One of the following or equal:
 - a. Ives.
 - b. Trimco.
 - c. Rockwood.
- B. Exit/Panic Device: As scheduled.
 - 1. Manufacturers: One of the following or equal:
 - a. Adams Rite.
 - b. Vdams Rite.
 - c. Duprin.
 - d. Arrow.
- C. Floor stops: As scheduled with strike of suitable height to compensate for clearance between door and floor.
 - 1. Manufacturers: One of the following or equal:
 - a. Ives.
 - b. Trimco.
 - c. Rockwood.
- D. Mechanical holders: Foot-operated plunger with instant release by touch of toe and integral spring to keep constant shoe pressure against floor; brass.
 - 1. Manufacturers: The following or equal:
 - a. Glynn-Johnson.
- E. Automatic flush bolts: Mortise, bar with stop-mounted coordinator and strikes; materials as scheduled.
 - 1. Manufacturers: One of the following or equal:
 - a. Glynn-Johnson.
 - b. Hager Hinge Co.

- F. Kick plates: As scheduled, 0.050-inch thick, beveled edges, 10 inches high, 1-1/2 inches narrower than single doors, 1 inch narrower than leaf of door pairs.
 - 1. Manufacturers: One of the following or equal:
 - a. Ives.
 - b. Trimco.

- G. Gasketing systems: As scheduled, self-adhesive silicone seal, continuous at head and jambs, rated for fire and smoke in accordance with ASTM E 283, sound rated in accordance with ASTM E 90.
 - 1. Manufacturers: One of the following or equal:
 - a. Pemko Mfg. Co.
 - b. National Guard Products Inc.
 - c. Reese.

- H. Weatherstripping for exterior doors and smoke, light, and sound seals for interior doors.

- I. Thresholds: As scheduled, extruded aluminum, maximum 1/2-inch high, maximum slope of 1 foot in 2 feet.
 - 1. Manufacturers: One of the following or equal:
 - a. National Guard Products Inc.
 - b. Pemko Mfg. Co.

- J. Dustproof strike: As scheduled.
 - 1. Manufacturers: One of the following or equal:
 - a. Ives.
 - b. Trimco.

- K. Coordinator with filler bar: As scheduled, non-handed, series type length as required for door sizes indicated, complete with filler lengths as required, with mounting brackets and carry bars when required for proper operation; steel with manufacturer's standard prime finish capable of receiving painted finish.
 - 1. Manufacturers: One of the following or equal:
 - a. Glynn-Johnson Coordinators, Model COR Series.
 - b. Ives, Door Co-Ordinator, Model 900 Series.

- L. Door bottoms: As scheduled, extruded aluminum with vinyl insert, surface mounted, length equal to door width minus 2 inches, automatic, recessed in bottom of door.
 - 1. Manufacturers: One of the following or equal:
 - a. Pemko.
 - b. Reese.

- M. Astragals: As specified in Section 08120.

- N. Silencers: As scheduled, pneumatic gray rubber.
 - 1. Manufacturers: One of the following or equal:
 - a. Trimco.
 - b. Ives.
 - c. Rockwood.

2.07 FINISHES

- A. Brass and bronze: BHMA A156.18 626 (US26D), satin chrome.

- B. Steel: BHMA A156.18 652 (US26D), satin chrome.
- C. Stainless steel: BHMA A156.18 630 (US32D), satin stainless steel.
- D. Aluminum: BHMA A156.18 628 (US28).
- E. Plastic closer covers: Spray paint to match typical door hardware finish.
- F. Metal closer covers: Plate covers to match typical door hardware finish.
- G. Electromagnetic hold open devices: Manufacturer's standard brushed zinc finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect doors and door frames for damage or defects and examine hardware for compatibility with receiving conditions and suitable to intended use.
- B. Verify that required wall backing has been installed.

3.02 INSTALLATION

- A. Install finish hardware in accordance with manufacturer's templates and instructions.
- B. Accurately and properly fit hardware.
- C. Securely fasten fixed parts for smooth, trouble-free, non-binding operation.
- D. Fit faces of mortise parts snug and flush.
- E. Ensure that operating parts move freely and smoothly without binding, sticking, or excessive clearance.
- F. Protection:
 - 1. Protect door hardware from damage or marring of finish during construction, use strippable coatings, removable tapes, or other acceptable means.
 - 2. Ensure door hardware displays no evidence of finish paint after final building cleanup.
- G. Latch guard and dead bolts: Install so that bolts automatically engage in keeper, whether activated by closer or by manual pressure.
- H. Closers:
 - 1. Mount on opposite sides of corridors or vestibules, except at exterior doors.
 - 2. Mount for 180-degree swing wherever possible.
 - 3. Mount with drop plates at narrow top rail doors.
 - 4. Adjust to operate noiselessly and evenly.
 - 5. Have closer manufacturer regulate closers prior to final acceptance of project.

- I. Kick plates: Screw on push side of doors, unless otherwise indicated on the Drawings.
- J. Gasketing: Mount to provide complete contact between door and frame, finished floor, or both; and weathertight enclosure.
- K. Thresholds:
 1. Install immediately before inspection for final acceptance or protect from heavy traffic damage during construction.
 2. Cope to fit door frame profile and drill to suit required flush bolts and panic bolts.
 3. Unless indicated on the Drawings to be set in grout, set in double bead of sealant, tightly fit at jambs, and make waterproof.
 4. Fasten to concrete slab with 5/16-inch stainless steel flat head countersunk machine screws and concrete anchors at 8-inch centers.
- L. Silencers: Insert into predrilled holes in frames.

3.03 ADJUSTING

- A. Examine hardware in place for complete and proper installation. Lubricate bearing surfaces for proper function.
- B. Replace, rework, or otherwise correct defective door hardware, including incorrect hand or function.

3.04 CLEANING

- A. Remove protective materials and devices and thoroughly clean exposed surfaces of hardware.
- B. Check for surface damage prior to final cleaning for acceptance of project.

3.05 HARDWARE SCHEDULE

HARDWARE GROUP HW-1 (EXTERIOR DOUBLE DOOR – 1 ACTIVE LEAF AND SINGLE DOOR)		
Hinges	6	Ives, 5BB1, 4-1/2 x 4-1/2, US32D
Threshold	1	Pemko, 170 A
Exit Device	1	Von Duprin, 98/99 Series
Weatherstrip	1 Set	Pemko, 303 AS
Door Bottom	2	Pemko, 222 AV
Kick Plate	2	Ives, 8400, 8 x 34, US32D
Flush Bolts	1 Set	Ives, FB457, US26D
Lockset	1	Schlage, ND10S RHO RD 626

END OF SECTION

SECTION 09910

PAINTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Field applied paints and coatings for normal exposures.
 - 2. Painting Accessories.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
 - a. Section 01330 - Submittal Procedures.
 - b. Section 01600 - Product Requirements.
 - c. Section 01770 - Closeout Procedures.

1.02 DEFINITIONS

- A. Paints: Manufacturer's best ready-mixed coatings, except when field catalyzed, with fully ground pigments having soft paste consistency and capable of being readily and uniformly dispersed to complete homogeneous mixture, having good flowing and brushing properties, and capable of drying or curing free of streaks or sags.
- B. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon.

1.03 SUBMITTALS

- A. General: Submit as specified in Section 01330.
- B. Shop drawings: Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data.
- C. Product data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips.
- D. Samples: Include 8-inch square draw-downs or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.

- E. Manufacturer's instructions: Submit in accordance with requirements for Product Data. Include:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.
 - 5. Precautions for applications free of defects.
 - 6. Surface preparation.
 - 7. Method of application.
 - 8. Recommended number of coats.
 - 9. Recommended thickness of each coat.
 - 10. Recommended total thickness.
 - 11. Drying time of each coat, including prime coat.
 - 12. Required prime coat.
 - 13. Compatible and non-compatible prime coats.
 - 14. Recommended thinners, when recommended.
 - 15. Limits of ambient conditions during and after application.
 - 16. Time allowed between coats.
 - 17. Required protection from sun, wind and other conditions.
 - 18. Touch-up requirements and limitations.

1.04 QUALITY ASSURANCE

- A. Products: First line or best grade.
- B. Materials for each paint system: By single manufacturer.
- C. Applicator qualifications: Applicator of products similar to specified products with minimum 3 years experience.
- D. Regulatory requirements: Comply with by using paints that do not exceed governing agency's VOC limits or do not contain lead.
- E. Field samples:
 - 1. Paint 1 complete surface of each color scheme to show colors, finish texture, materials, and workmanship.
 - 2. Obtain approval before painting other surfaces.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products as specified in Section 01600.
- B. Remove unspecified and unapproved paints from Project site immediately.
- C. Deliver containers with labels identifying:
 - 1. Manufacturer's name.
 - 2. Brand name.
 - 3. Product type.
 - 4. Batch number.
 - 5. Date of manufacturer.
 - 6. Expiration date or shelf life.
 - 7. Color.
 - 8. Mixing and reducing instructions.

- D. Store coatings in well-ventilated facility that provides protection from the sun weather, and fire hazards.
 - 1. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.
- E. Take precautions to prevent fire and spontaneous combustion.

1.06 ENVIRONMENTAL CONDITIONS

- A. Surface moisture contents: Do not paint surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:
 - 1. Plaster and gypsum wallboard: 12 percent.
 - 2. Masonry, concrete and concrete block: 12 percent.
 - 3. Interior located wood: 15 percent.
 - 4. Concrete floors: 7 percent.
- B. Do not paint or coat:
 - 1. Under dusty conditions.
 - 2. When light on surfaces measures less than 15 foot-candles.
 - 3. When ambient or surface temperature is less than 50 degrees Fahrenheit or unless manufacturer allow a lower temperature.
 - 4. When relative humidity is higher than 85 percent, unless manufacturer allows a higher relative humidity.
 - 5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
 - 6. When surface temperature exceeds the manufacturer's recommendation.
 - 7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
 - 8. Apply clear finishes at minimum 65 degrees Fahrenheit.
- C. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 50 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.

1.07 PROTECTION

- A. Protect adjacent surfaces from paint and damage. Repair damage resulting from inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

- C. Place cotton waste, cloths, and material that may constitute fire hazard in closed metal containers and remove daily from site.
- D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations.
 - 1. Carefully store, clean and replace on completion of painting in each area.
 - 2. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

1.08 EXTRA MATERIALS

- A. Extra materials: Deliver as specified in Section 01770. Include minimum 1 gallon of each type and color of coating applied:
 - 1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
 - 2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paints: One of the following or equal:
 - 1. Carboline: Carboline, St. Louis, MO.
 - 2. ICI/Devoe: ICI/Devoe/AkzoNobel, Strongsville, OH.
 - 3. Rustoleum: Rustoleum Corp., Sommerset, NJ.
 - 4. S/W: Sherwin-Williams Co., Cleveland, OH.
 - 5. Tnemec: Tnemec Co., Kansas City, MO.
- B. Submit requests for substitutions as specified in Section 01600:
 - 1. Include certified ingredient analyses.
 - 2. Provide colors that match specified colors.

2.02 PRETREATMENT, PRIMERS, PRIMER-SEALERS, AND WOOD STAIN

- A. Aluminum primer: One of following or equal:
 - 1. Carboline: Carbocrylic 120.
 - 2. ICI/Devoe: Devflex 4020 DTM.
 - 3. S/W: DTM Wash Primer.
- B. Concrete masonry filler/primer: One of following or equal:
 - 1. Carboline: Sanitile 100.
 - 2. ICI/Devoe: Bloxfill 4000.
 - 3. S/W: HD Block Filler, B42W46.
 - 4. Tnemec:
 - a. Series 130, Envirofill.
 - b. Series 180, Tneme-crete.
- C. Concrete, porous, filler/primer: One of following or equal:
 - 1. Carboline: Sanitile 100.
 - 2. ICI/Devoe: Bloxfill 4000.

3. S/W: HD Block Filler, B42W46.
 4. Tnemec:
 - a. Series 130, Envirofill.
 - b. Series 180, Tneme-crete.
- D. Concrete, smooth, filler/primer: One of following or equal:
1. Carboline: Sanitile 100.
 2. Carboline: Carbocrylic 120.
 3. ICI/Devoe:
 - a. Bloxfill 4000.
 - b. Prep & Prime, Bond Prep 3030.
 4. S/W:
 - a. HD Block Filler, B42W46.
 - b. Epoxy Masonry Tilt Primer White B42WW49.
 5. Tnemec: Series 180, Tneme-Crete.
- E. Ferrous metal primer: One of following or equal:
1. Carboline: Carbocrylic 890.
 2. ICI/Devoe: Barrust 233.
 3. S/W: Macropoxy 646.
 4. Tnemec: Series 104.
- F. Galvanized metal surface pretreatment materials: One of following or equal:
1. Carboline: Surface Cleaner 3.
 2. ICI/Devoe: Devprep 88.
- G. Galvanized metal surface primer: One of following or equal:
1. Carboline: Carbocrylic 890.
 2. ICI/Devoe: Barrust 233.
 3. S/W: Macropoxy 646.
 4. Tnemec: Series 104.
- H. Plaster sealer: One of following or equal:
1. Carboline:Sanitile 120.
 2. ICI/Devoe: Prep & Prime, Bond Prep 3030.
 3. S/W:
 - a. Promar 200 Primer B28W8200.
 - b. Loxon Masonry Primer A24W300.
- I. Plywood, latex finishes: One of following or equal:
1. Carboline: Sanitile 120.
 2. ICI/Devoe:
 - a. Exterior: Prep & Prime, Hydrosealer 6001.
 - b. Interior: Prep & Prime, Hi Hide Wall 1000.
 3. S/W: A100 Latex Primer B42W8041.
- J. Wood primer for opaque finish paint, interior exposure: One of following or equal:
1. Carboline: Sanitile 120.
 2. ICI/Devoe: Prep & Prime, Gripper 3210.
 3. S/W: PrepRite Latex Primer B28W111.
- K. Wood primer for opaque finish paint, exterior exposure: One of following or equal:
1. Carboline: Sanitile 120.

2. S/W: A-100 Primer B42W.
3. ICI/Devoe: Prep & Prime, Hydrosealer 6001.
4. Wood stain: One of following or equal:
 - a. S/W:
 - 1) Interior: Wood Classic.
 - 2) Exterior: Woodscapes.
 - b. Approved equal.

2.03 PAINTS, INTERIOR EXPOSURE

- A. Latex, flat: One of following or equal:
 1. Carboline: Carbocrylic 3359 flat.
 2. ICI/Devoe:
 - a. Dulux Ultra 1201.
 3. S/W: Promar 200, B30W200.
- B. Latex, semi-gloss: One of following or equal:
 1. Carboline: Carbocrylic 3359.
 2. ICI/Devoe:
 - a. Dulux Ultra 1407.
 3. S/W: Promar 200, B77W3402D.
- C. Alkyd, gloss: One of following or equal:
 1. ICI/Devoe: Glidden Lifemaster Oil 1508.
 2. S/W:
 - a. Industrial Enamel, B54Z.
 - b. Water based Industrial Enamel, B53W311.
- D. Acrylic, semi-gloss: One of following or equal:
 1. Carboline: Carbocrylic 3359.
 2. ICI/Devoe:
 - a. Dulux Ultra 1407.
 3. S/W: Promar 200, B77W3402D.
 4. Tnemec: Series 1029, Enduratone.
- E. Urethane varnish, clear: One of following or equal:
 1. ICI/Devoe: Woodpride 1802 Clear Interior Water-based Varnish.
 2. S/W: Wood Classics Waterborne Polyurethane Varnish Gloss Clear A68V91.
- F. Oil: The following or equal:
 1. Watco Danish Oil.

2.04 PAINTS, EXTERIOR EXPOSURE

- A. Latex, flat: One of following or equal:
 1. Carboline: Carbocrylic 3359 flat.
 2. ICI/Devoe:
 - a. Dulux Professional 2200V.
 3. S/W: A-100, Flat Exterior Latex A6-100.
 4. Tnemec: 1028 Enduratone.

- B. Alkyd, gloss: One of following or equal:
 - 1. ICI/Devoe: Glidden Lifemaster Oil 1508.
 - 2. S/W:
 - a. Industrial Enamel, B54Z.
 - b. Water based Industrial Enamel B53W311.

- C. Acrylic latex, semi-gloss: One of following or equal:
 - 1. Carboline: Carbocrylic 3359 flat.
 - 2. ICI/Devoe:
 - a. Dulux Professional 2406V.
 - 3. S/W: A-100, Flat Exterior Latex A6-100.
 - 4. Tnemec: 1028 Enduratone.

- D. Urethane varnish, clear: One of following or equal:
 - 1. ICI/Devoe: FLOOD Spa-N-Deck Waterborne System.

2.05 PENETRATING WATER REPELLENTS

- A. Silane, Penetrating Water Repellent: Clear, containing 20 percent or more solids of alkyltrialkoxysilanes; with alcohol, mineral spirits, water, or other proprietary solvent carrier; and with 400 g/L or less of VOCs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals, LLC; Hydrozo 100 Plus.
 - b. Pecora Corporation; KlereSeal 940-S VOC KlereSeal 9100-S.
 - c. PROSOCO, Inc.; SLX100.
 - d. Tnemec Inc.; Dur A Pell 100.

PART 3 EXECUTION

3.01 INSPECTION

- A. Thoroughly examine surfaces scheduled to be painted before starting work.
- B. Start painting when unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Prepare surfaces in accordance with paint manufacturer's instructions or when none, the following:
 - 1. Aluminum:
 - a. Remove surface contamination by steam, high-pressure water, or degreasers.
 - b. Abrade surface by abrasive blasting, power tool cleaning or hand tool cleaning.
 - c. Apply etching primer.
 - 2. Reinforced concrete panels:
 - a. Remove dirt, powdery residue, and foreign matter.
 - b. Paint immediately; both sides when applicable.
 - 3. Canvas and cotton insulation coverings: Remove dirt, grease, and oil.
 - 4. Concrete floors:

- a. Remove contamination, abrasive blast or acid etch and rinse with clear water.
- b. Ensure required acid-alkali balance is achieved. Allow to dry thoroughly.
5. Copper for paint finish:
 - a. Remove contamination by steam, high-pressure water, or degreasers.
 - b. Abrade surface by abrasive blasting, power tool cleaning or hand tool cleaning.
 - c. Apply vinyl etch primer.
6. Copper for oxidized finish:
 - a. Remove contamination.
 - b. Apply oxidizing solution of copper acetate and ammonium chloride in acetic acid.
 - c. Rub on repeatedly for correct effect.
 - d. Once attained rinse surfaces well with clear water and allow to dry.
7. Gypsum wallboard:
 - a. Remove contamination and prime to show defects.
 - b. Repair and prime defects.
8. Galvanized surfaces:
 - a. Remove surface contamination and oils and wash with degreasers.
 - b. Apply coat of etching type primer.
9. Zinc coated surfaces: Remove surface contamination and oils and prepare for priming in accordance with metal manufacturer's recommendations.
10. Concrete and concrete masonry:
 - a. Remove dirt, loose mortar, scale, powder and other foreign matter.
 - b. Remove oil and grease with solution of tri-sodium phosphate.
 - c. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate.
 - d. Rinse well and allow to thoroughly dry.
 - e. Spot prime exposed metal with alkyd primer.
11. Plaster:
 - a. Fill hairline cracks, small holes and imperfections with patching plaster.
 - b. Smooth off to match adjacent surfaces.
 - c. Wash and neutralize high alkali surfaces where they occur.
12. Unprimed steel and iron: Remove grease, rust, scale, dirt and dust by wire brushing, sandblasting or other necessary method.
13. Shop primed steel:
 - a. Sand and scrape to remove loose primer and rust.
 - b. Feather out edges to make touch-up patches inconspicuous.
 - c. Clean surfaces.
 - d. Prime bare steel surfaces.
14. Wood and millwork:
 - a. Sandpaper to smooth even surface.
 - b. Wipe off dust and grit prior to priming.
 - c. Spot coat knots, pitch streaks, and sappy sections with sealer.
 - d. Fill nail holes and cracks after primer has dried and sand between coats.
15. Exterior wood siding:
 - a. Remove dust, grit, and foreign matter.
 - b. Seal knots, pitch streak, and sappy sections.
 - c. Fill nail holes with exterior caulking compound after prime coat has been applied.

16. Mildew:
 - a. Remove by scrubbing with solution of tri-sodium phosphate and chlorine bleach.
 - b. Rinse with clean water and allow surface to dry completely.
17. Glue laminated woods:
 - a. Remove grease and dirt.
 - b. Wash down surfaces with degreasers.

3.03 APPLICATION

- A. Apply each coat at proper consistency.
- B. Tint each coat of paint slightly darker than preceding coat.
- C. Sand lightly between coats to achieve required finish.
- D. Do not apply finishes on surfaces that are not sufficiently dry.
- E. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.
- F. Where clear finishes are required ensure tint fillers match wood.
 1. Work fillers well into grain before set.
 2. Wipe excess from surface.
- G. Backprime exterior woodwork, which is to receive paint finish, with exterior primer paint.
- H. Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoat paint.
- I. Backprime interior and exterior woodwork, which is to receive stain or varnish finish, with gloss varnish reduced 25 percent with mineral spirits.
- J. Prime top and bottom edges of wood and metal doors with enamel undercoat when they are to be painted.
- K. Prime top and bottom edges of wood doors with gloss varnish when they are to receive stain or clear finish.

3.04 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Identify equipment, ducting, piping, and conduit in accordance with Related Sections.
- B. Remove grilles, covers, and access panels for mechanical and electrical system from location and paint separately.
- C. Finish paint primed equipment with color selected by the Engineer.
- D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are plated or covered with prefinished coating.

- E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
- F. Paint interior surfaces of air ducts, convactor, and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.
- G. Paint dampers exposed immediately behind louvers, grilles, convactor, and baseboard cabinets to match face panels.
- H. Paint exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.
- I. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
- J. Color code equipment, piping, conduit, exposed ductwork, and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with the Contract Documents.

3.05 SURFACES NOT REQUIRING FINISHING

- A. Stainless steel, brass, bronze, copper, monel, chromium, anodized aluminum: Specially finished articles such as porcelain enamel, plastic coated fabrics, and baked enamel.
- B. Finished products such as ceramic tile, windows, glass, brick, resilient flooring, acoustical tiles, board and metal tees; other architectural features, such as finish hardware, furnished in aluminum, bronze or plated ferrous metal, prefinished panels, or other items that are installed prefinished.
- C. Items completely finished at factory, such as preformed metal roof and wall panels, aluminum frames, toilet compartments, sound control panels, acoustical tiles, shower compartments, folding partition, and flagpole.

3.06 CLEANING

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of work, keep premises free from unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Upon completion of work, leave premises neat and clean.

3.07 PIPING COLOR CODE AND MARKER SCHEDULE

Service Fluid	Pipe Color	Marker Legend
Chemical Drain	Charcoal	CHEMICAL DRAIN
Drain	Charcoal	DRAIN
Instrumental Air	Purple	INSTRUMENTATION AIR

Service Fluid	Pipe Color	Marker Legend
Sample	Green	FLUID BEING SAMPLED
Sanitary Drain	Charcoal	SANITARY DRAIN
Service Air	Green	SERVICE AIR
Tank Drain	Charcoal	TANK DRAIN
Vent Pipe	Yellow	VENT PIPE

Letters	Color of Pipe	Color of Bands	Color of Letters
Nonpotable or Raw	Light blue	Dark Gray	Black
Sample	Dark Blue	Black	White
Fire Protection	Red	None	Black
Hydrants	Aluminum	None	Black
Drain	Dark Gray	None	White
Stainless Steel Pipe	White	Red	White
Compressed Air	Light Green	None	Black
Instrument Air	Light Green	Dark Green	Black
Backwash Air (Low Pressure)			
Stainless Steel Pipe	None	None	Black
Other Pipe	Light Green	None	Black

END OF SECTION

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SECTION 09960

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Field-applied coatings.

1.02 REFERENCES

- A. ASTM International (ASTM):
1. D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
 2. D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- B. International Concrete Repair Institute (ICRI):
1. Guideline 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
- C. NACE International (NACE):
1. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 2. SP0188 - Discontinuity (Holiday) Testing of Protective Coatings.
- D. National Association of Pipe Fabricators (NAPF):
1. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
- E. NSF International (NSF):
1. 61 - Drinking Water System Components - Health Effects.
- F. Society for Protective Coatings (SSPC):
1. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
 2. SP 1 - Solvent Cleaning.
 3. SP 2 - Hand Tool Cleaning.
 4. SP 3 - Power Tool Cleaning.
 5. SP 5 - White Metal Blast Cleaning.
 6. SP 6 - Commercial Blast Cleaning.
 7. SP 7 - Brush-Off Blast Cleaning.
 8. SP 10 - Near-White Blast Cleaning.
 9. SP 13 - Surface Preparation of Concrete.
- G. United States Environmental Protection Agency (EPA):
1. Method 24 - Surface Coatings.

1.03 DEFINITIONS

- A. Submerged metal: Steel or iron surfaces below tops of channel or structure walls that will contain water even when above expected water level.
- B. Submerged concrete and masonry surfaces: Surfaces that are or will be:
 - 1. Underwater.
 - 2. In structures that normally contain water.
 - 3. Below tops of walls of water-containing structures.
- C. Exposed surface: Any metal or concrete surface, indoors or outdoors, that is exposed to view.
- D. Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.
- E. Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.
- F. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
- G. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.04 PERFORMANCE REQUIREMENTS

- A. Coating materials shall be especially adapted for use in wastewater treatment plants.
- B. Coating materials used in contact with potable water supply systems shall be certified to NSF 61.

1.05 SUBMITTALS

- A. General: Submit as specified in Section 01330 - Submittal Procedures.
- B. Shop drawings:
 - 1. Schedule of proposed coating materials.
 - 2. Schedule of surfaces to be coated with each coating material.
- C. Product data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
 - 1. Regulatory requirements: Submit data concerning the following:
 - a. VOC limitations.
 - b. Coatings containing lead compounds and polychlorinated biphenyls.
 - c. Abrasives and abrasive blast cleaning techniques, and disposal.
 - d. NSF certification of coatings for use in potable water supply systems.

- D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number, sheen name, and gloss units.
- E. Certificates: Submit in accordance with requirements for Product Data.
- F. Manufacturer's instructions: Include the following:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.
 - 5. Precautions for applications free of defects.
 - 6. Surface preparation.
 - 7. Method of application.
 - 8. Recommended number of coats.
 - 9. Recommended DFT of each coat.
 - 10. Recommended total DFT.
 - 11. Drying time of each coat, including prime coat.
 - 12. Required prime coat.
 - 13. Compatible and non-compatible prime coats.
 - 14. Recommended thinners, when recommended.
 - 15. Limits of ambient conditions during and after application.
 - 16. Time allowed between coats (minimum and maximum).
 - 17. Required protection from sun, wind, and other conditions.
 - 18. Touch-up requirements and limitations.
 - 19. Minimum adhesion of each system submitted in accordance with ASTM D4541.
- G. Manufacturer's Representative's Field Reports.
- H. Operations and Maintenance Data: Submit as specified in Section 01770 - Closeout Procedures:
 - 1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
 - 2. Reports on visits to project site to observe and approve coating application procedures.
 - 3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are "shop coated."
- I. Quality Assurance Submittals:
 - 1. Quality assurance plan.
 - 2. Qualifications of coating applicator including List of Similar Projects.
- J. Certifications:
 - 1. Submit notarized certificate that:
 - a. All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations.

1.06 QUALITY ASSURANCE

- A. Applicator qualifications:
 - 1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work:
 - a. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
 - 2. Manufacturer-approved applicator when manufacturer has approved applicator program.
 - 3. Approved and licensed by polymorphic polyester resin manufacturer to apply polymorphic polyester resin coating system.
 - 4. Approved and licensed by elastomeric polyurethane (100-percent solids) manufacturer to apply 100-percent solids elastomeric polyurethane system.
 - 5. Applicator of off-site application of coal-tar epoxy shall have successfully applied coal-tar epoxy on similar surfaces in material, size, and complexity as on the Project.
- B. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible VOC limits and do not contain lead:
 - 1. Do not use coal-tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
- C. Certification: Certify that applicable pigments are resistant to discoloration or deterioration when exposed to hydrogen sulfide and other sewage gases and product data designates coating as suitable for wastewater service.
- D. Field samples:
 - 1. Prepare and coat a minimum 100-square-foot area between corners or limits such as control or construction joints of each system.
 - 2. Approved field sample may be part of the Work.
 - 3. Obtain approval before painting other surfaces.
- E. Pre-installation conference: Conduct as specified in Section 01312 - Project Meetings.
- F. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.
- G. Services of coating manufacturer's representative: Arrange for coating manufacturer's representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be "shop-primed and coated."

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products as specified in Section 01600 - Product Requirements.
- B. Remove unspecified and unapproved paints from Project site immediately.

- C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
 - 1. Do not deliver materials aged more than 12 months from manufacturing date.
- D. Store coatings in well-ventilated facility that provides protection from the sun weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.
- E. Take precautions to prevent fire and spontaneous combustion.

1.08 PROJECT CONDITIONS

- A. Surface moisture contents: Do not coat surfaces that exceed manufacturer-specified moisture contents, or when not specified by the manufacturer, with the following moisture contents:
 - 1. Plaster and gypsum wallboard: 12 percent.
 - 2. Masonry, concrete, and concrete block: 12 percent.
 - 3. Interior located wood: 15 percent.
 - 4. Concrete floors: 7 percent.
- B. Do not apply coatings:
 - 1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
 - 2. When light on surfaces measures less than 15 foot-candles.
 - 3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
 - 4. When relative humidity is higher than 85 percent.
 - 5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
 - 6. When surface temperature exceeds the manufacturer's recommendation.
 - 7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
 - 8. Apply clear finishes at minimum 65 degrees Fahrenheit.
- C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during, and 48 hours after application of finishes.
- E. Dehumidification and heating for coating of high humidity enclosed spaces:
 - 1. Provide dehumidification and heating of digester interior spaces in which surface preparation, coating application, or curing is in progress according to the following schedule:
 - a. October 1 to April 30: Provide continuous dehumidification and heating as required to maintain the tanks within environmental ranges as specified in this Section and as recommended by the coating material manufacturer. For the purposes of this Section, "continuous" is defined as 24 hours per day and 7 days per week.

- b. May 1 to September 30: Provide temporary dehumidification and heating as may be required to maintain the tanks within the specified environmental ranges in the event of adverse weather or other temporary condition. At Contractor's option and at his sole expense, Contractor may suspend work until such time as acceptable environmental conditions are restored, in lieu of temporary dehumidification and heating. Repair or replace any coating or surface preparation damaged by suspension of work, at Contractor's sole expense.
- 2. Equipment requirements:
 - a. Capacity: Provide dehumidification, heating, and air circulation equipment with minimum capacity to perform the following:
 - 1) Maintain the dew point of the air in the tanks at a temperature at least 5 degrees Fahrenheit less than the temperature of the coldest part of the structure where work is underway.
 - 2) Reduce dew point temperature of the air in the tanks by at least 10 degrees Fahrenheit in 20 minutes.
 - 3) Maintain air temperature in the tanks at 60 degrees Fahrenheit minimum.
 - b. Systems:
 - 1) Dehumidification: Provide desiccant or refrigeration drying. Desiccant types shall have a rotary desiccant wheel capable of continuous operation. No liquid, granular, or loose lithium chloride drying systems will be allowed.
 - 2) Heating: Electric, indirect combustion, or steam coil methods may be used. Direct-fired combustion heaters will not be allowed during abrasive blasting, coating application, or coating cure time.
- 3. Design and submittals:
 - a. Contractor shall prepare dehumidification and heating plan for this project, including all equipment and operating procedures.
 - b. Suppliers of services and equipment shall have not less than 3 years of experience in similar applications.
 - 1) Manufacturers: The following or equal:
 - a) Cargocaire Corp. (Munters).
 - c. Submit dehumidification and heating plan for Engineer's review.
- 4. Monitoring and performance:
 - a. Measure and record relative humidity and temperature of air, and structure temperature twice daily (beginning and end of work shifts) to verify that proper humidity and temperature levels are achieved inside the work area after the dehumidification equipment is installed and operational. Test results shall be made available to the Engineer upon request.
 - b. Interior space of the working area and tank(s) shall be sealed, and a slight positive pressure maintained as recommended by the supplier of the dehumidification equipment.
 - c. The filtration system used to remove dust from the air shall be designed so that it does not interfere with the dehumidification equipment's ability to control the dew point and relative humidity inside the reservoir.
 - 1) The air from the tank, working area, or dust filtration equipment shall not be recirculated through the dehumidifier during coating application or when solvent vapors are present.

1.09 SEQUENCING AND SCHEDULING

- A. Sequence and Schedule: As specified in Section 01140 - Work Restrictions.

1.10 MAINTENANCE

- A. Extra materials: Deliver as specified in Section 01770 - Closeout Procedures. Include minimum 1 gallon of each type and color of coating applied:
 - 1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
 - 2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Special coatings: One of the following or equal:
 - 1. Carboline: Carboline.
 - 2. Ceilcote: International Protective Coatings.
 - 3. Dampney: The Dampney Co.
 - 4. Devoe: International Protective Coatings.
 - 5. Dudick: Dudick, Inc.
 - 6. GET: Global Eco Technologies.
 - 7. Henkel: Henkel North America.
 - 8. IET: Integrated Environmental Technologies.
 - 9. PPC: Polymorphic Polymers Corp.
 - 10. PPG Amercoat: PPG Protective & Marine Coatings.
 - 11. Rustoleum: Rustoleum Corp.
 - 12. Sanchem: Sanchem.
 - 13. Superior: Superior Environmental Products, Inc.
 - 14. S-W: Sherwin-Williams Co.
 - 15. Tnemec: Tnemec Co.
 - 16. Wasser: Wasser High Tech Coatings.
 - 17. ZRC: ZRC Worldwide Innovative Zinc Technologies.

2.02 PREPARATION AND PRETREATMENT MATERIALS

- A. Metal pretreatment:
 - 1. Manufacturers: One of the following or equal:
 - a. Henkel, Galvaprep 5.
 - b. International, AWLGrip Alumiprep 33.
- B. Surface cleaner and degreaser:
 - 1. manufacturers: One of the following or equal:
 - a. Carboline Surface Cleaner No. 3.
 - b. Devoe, Devprep 88.
 - c. S-W, Clean and Etch.

2.03 COATING MATERIALS

- A. Alkali-resistant bitumastic:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Bitumastic No. 50.
 - b. S-W, Targuard.
 - c. Wasser, MC-Tar.
 - d. As specified for Coal Tar Epoxy Substitute.

- B. Wax coating:
 - 1. Manufacturers: The following or equal:
 - a. Sanchem, No-Ox-Ild A special.

- C. High solids epoxy (self-priming) not less than 72 percent solids by volume:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Carboguard 891.
 - b. Devoe, Bar Rust 233H.
 - c. PPG Amercoat: Amerlock 2.
 - d. S-W, Macropoxy 646.
 - e. Tnemec, HS Epoxy Series 104.

- D. Aliphatic or aliphatic-acrylic polyurethane:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Carbothane 134 VOC.
 - b. Devoe, Devthane 379.
 - c. PPG Amercoat: Amershield VOC.
 - d. Non-submerged: S-W High Solids Polyurethane.
 - e. Tnemec, Endura-Shield II Series 1075 (U).

- E. Polymorphic polyester resin coating system: 2-component, modified styrene based thermoset resin, EPA approved for potable water, with 100 percent solids and maximum 10 grams per liter VOC.
 - 1. Manufacturers: One of the following or equal:
 - a. IET: IET Prime Coat DS-101, Intermediate Coat DS-301, and Finish Coat DS 401.
 - b. PPC: PPC Prime Coat, IC-Filler Coat, and FC-Final Coat.

- F. High-temperature coating 150 to 350 degrees Fahrenheit:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Thermaline 4900.
 - b. Dampney, Thermalox 245 Silicone - Zinc Dust.
 - c. PPG Amercoat: Amerlock 2/400 GFK.

- G. High-temperature coating 400 to 1,000 degrees Fahrenheit (dry):
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Thermaline 4700.
 - b. Dampney, Thermolox 230C Series Silicone.
 - c. Devoe, HT-12, High Heat Silicone.

- H. High-temperature coating up to 1,400 degrees Fahrenheit:
 - 1. Manufacturers: The following or equal:
 - a. Dampney, Thermalox 240 Silicone Ceramix.

- I. Asphalt varnish: AWWA C 500.
- J. Protective coal tar:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Bitumastic No. 50.
 - b. PPG Amercoat: 78HB
 - c. As specified for Coal Tar Epoxy.
- K. Coal-tar epoxy:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, 300-M, Bitumastic.
 - b. PPG Amercoat: 78HB.
 - c. S-W, Tar Guard 100.
 - d. Tnemec, Series 46H-413.
- L. Vinyl ester: Glass mat reinforced, total system 125 mils DFT:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Semstone 870.
 - b. Ceilcote, 6640 Ceilcrete.
 - c. Dudick, Protecto-Flex 800.
 - d. Tnemec, Chembloc Series 239SC.
- M. Elastomeric polyurethane, 100-percent solids, ASTM D16, Type V, (Urethane P):
 - 1. Manufacturers: The following or equal:
 - a. GET, Endura-Flex EF-1988.
- N. Concrete floor coatings:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Semstone 140SL.
 - b. Devoe, Devran 124.
 - c. Dudick, Polymer Alloy 1000.
 - d. Tnemec, Tneme-Glaze Series 282.
- O. Waterborne acrylic emulsion:
 - 1. Manufacturers: One of the following or equal:
 - a. S-W, DTM Acrylic B66W1.
 - b. Tnemec, Tneme-Cryl Series 6.
- P. Galvanizing zinc compound:
 - 1. Manufacturers: One of the following or equal:
 - a. ZRC, Cold Galvanizing Compound.

2.04 COATING MATERIALS

- A. Alkali-resistant bitumastic:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Bitumastic No. 50 WB.
 - b. S-W, Targuard 100.
 - c. As specified for Coal Tar Epoxy Substitute.
- B. Wax coating:
 - 1. Manufacturers: The following or equal:
 - a. Sanchem, No-Ox-Id A special.

- C. High solids epoxy (self-priming) not less than 72-percent solids by volume with a mixed applied flash point of 140 degrees Fahrenheit or less:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline:
 - 1) Non-submerged: Carboguard 890 VOC.
 - 2) Submerged: Phenoline 341 (100-percent solids, 2-component epoxy).
 - b. Devoe:
 - 1) Bar Rust 233 Low VOC.
 - 2) Devran 133 (100-percent solids, 2-component epoxy).
 - c. S-W:
 - 1) Non-submerged: Macropoxy 646-100.
 - d. PPG Amercoat: Amerlock 2 VOC.

- D. Aliphatic or aliphatic-acrylic polyurethane not less than 80-percent solids with a mixed flash point of 140 degrees Fahrenheit or less:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Carbothane 134MC.
 - b. Devoe, Devthane 379 H.
 - c. S-W, High Solids Polyurethane 100.
 - d. PPG Amercoat: Amershield VOC.

- E. Polymorphic polyester resin coating system: 2-component, modified styrene based thermoset resin, EPA approved for potable water, with 100 percent solids and maximum 10 grams per liter VOC:
 - 1. Manufacturers: One of the following or equal:
 - a. IET: IET Prime Coat DS-101, Intermediate Coat DS-301, and Finish Coat DS 401.
 - b. PPC: PPC Prime Coat, IC-Filler Coat, and FC-Final Coat.

- F. High-temperature coating 150 to 350 degrees Fahrenheit:
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Thermaline 4900.
 - b. Dampney, Thermalox 245 Silicone - Zinc Dust.
 - c. PPG Amercoat: Amerlock 2/400 GFK.

- G. High-temperature coating 400 to 1,000 degrees Fahrenheit (Dry):
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Thermaline 4700 VOC.
 - b. Dampney, Thermolox 230C Series Silicone.
 - c. Devoe, HT-12, High Heat Silicone.

- H. High-temperature coating up to 1,400 degrees Fahrenheit:
 - 1. Manufacturers: The following or equal:
 - a. Dampney, Thermalox 240 Silicone Ceramix.

- I. Asphalt varnish: AWWA C 500.

- J. Coal tar: Where coal tar, coal-tar epoxy, or coal-tar mastic are specified or indicated on the Drawings, coal-tar epoxy substitute, as specified, shall be used in their place. Coal tar shall not be allowed.

- K. Coal-tar epoxy substitute:
 - 1. Manufacturers: One of the following or equal:
 - a. Devoe, Devtar 5A HS.
 - b. S-W, Macropoxy 646 Black.

- L. Vinyl ester: Glass mat reinforced, total system 125 mils DFT, manufacturer's recommended topcoat.
 - 1. Manufacturers: One of the following or equal:
 - a. Carboline, Semstone 870.
 - b. Ceilcote, 6640 Ceilcrete.
 - c. Dudick, Protecto-Flex 800.
 - d. Tnemec, Chembloc Series 239SC.

- M. Elastomeric polyurethane 100-percent solids, ASTM D16, Type V, (Urethane P):
 - 1. Manufacturers: The following or equal:
 - a. GET, Endura-Flex EF-1988.

- N. Concrete floor coatings:
 - 1. Manufacturers: One of the following or equal:
 - a. Devoe, Devran 124.
 - b. Dudick, Polymer Alloy 1000.
 - c. Tnemec, Tneme-Glaze Series 282.

- O. Waterborne acrylic emulsion:
 - 1. Manufacturers: One of the following or equal:
 - a. S-W, DTM Acrylic B66W1.
 - b. Tnemec, Tneme-Cryl Series 6.

- P. Galvanizing zinc compound:
 - 1. Manufacturers: The following or equal:
 - a. ZRC, Cold Galvanizing Compound.

2.05 MIXES

- A. Mix in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 GENERAL PROTECTION

- A. Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection.

- B. Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
 - 1. Mask off surfaces of items not to be coated or remove items from area.

- C. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and, in particular, surfaces within storage and preparation areas.

- D. Place cotton waste, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from site.
- E. Remove electrical plates, surface hardware, fittings, and fastenings prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

3.02 GENERAL PREPARATION

- A. Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.
- B. Protect the following surfaces from abrasive blasting by masking or other means:
 - 1. Threaded portions of valve and gate stems, grease fittings, and identification plates.
 - 2. Machined surfaces for sliding contact.
 - 3. Surfaces to be assembled against gaskets.
 - 4. Surfaces of shafting on which sprockets are to fit.
 - 5. Surfaces of shafting on which bearings are to fit.
 - 6. Machined surfaces of bronze trim, including slide gates.
 - 7. Cadmium-plated items except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
 - 8. Galvanized items, unless scheduled to be coated.
- C. Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.
- D. Concrete:
 - 1. Allow new concrete to cure for minimum of 28 days before coating.
 - 2. Clean concrete surfaces of dust, mortar, fins, loose concrete particles, form release materials, oil, and grease. Fill voids so that surface is smooth. Prepare concrete surface for coating in accordance with SSPC SP 13. Provide ICRI 310.2 CSP-3 surface profile, or as recommended by coating manufacturer. All concrete surfaces shall be vacuumed clean prior to coating application.
- E. Ferrous metal surfaces:
 - 1. Remove grease and oil in accordance with SSPC SP 1.
 - 2. Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
 - 3. Abrasive blast surfaces prior to coating.
 - a. When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.
 - b. When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching up.
 - c. Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP 10, unless blasting may damage adjacent surfaces, prohibited, or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP 3.
 - d. Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP 5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils

- in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.
4. All abrasive blast cleaned surfaces shall be blown down with clean dry air and/or vacuumed.
- F. Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.
- G. Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.
- H. Galvanized surface:
1. Degrease or solvent clean (SSPC SP 1) to remove oily residue.
 2. Power tool or hand tool clean or whip abrasive blast.
 3. Test surface for contaminants using copper sulfate solution.
 4. Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.
- I. Shop-primed metal:
1. Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
 2. Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP 10, unless greater degree of surface preparation is required by coating manufacturer's representative.
 3. Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP 2, SP 3, or SP 6, as directed by the Engineer. When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer's representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP 10.
 4. When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP 10.
 5. When prime coat not authorized by Engineer is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP 10.
 6. Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.
- J. Cadmium-plated, zinc-plated, or sherardized fasteners:
1. Abrasive blast in the same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.
- K. Abrasive blast components that are to be attached to surfaces that cannot be abrasive blasted before components are attached.
- L. Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.
- M. Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.

- N. Polyvinyl chloride (PVC) and FRP surfaces:
 - 1. Prepare surfaces to be coated by light sanding (de-gloss) and wipe-down with clean cloths, or by solvent cleaning in strict accordance with coating manufacturer's instructions.

- O. Cleaning of previously coated surfaces:
 - 1. Utilize cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:
 - a. Cleaning agent: Biodegradable non-flammable and containing no VOC.
 - b. Manufacturer: The following or equal:
 - 1) CHLOR*RID International, Inc.
 - 2. Steam clean and degrease surfaces to be coated to remove oils and grease.
 - 3. Cleaning of surfaces utilizing the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high-pressure washing, or hand washing as approved by the coating manufacturer's representative and the Engineer.
 - 4. Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.
 - 5. Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

3.03 MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

- A. Identify equipment, ducting, piping, and conduit as specified in Section 15075 - Equipment Identification.

- B. Remove grilles, covers, and access panels for mechanical and electrical system from location and coat separately.

- C. Prepare and finish coat primed equipment with color selected by the Engineer.

- D. Prepare and prime and coat insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.

- E. Replace identification markings on mechanical or electrical equipment when coated over or spattered.

- F. Prepare and coat interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.

- G. Prepare and coat dampers exposed immediately behind louvers, grilles, and convector and baseboard heating cabinets to match face panels.

- H. Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.

- I. Prepare and coat both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

- J. Color code equipment, piping, conduit, and exposed ductwork and apply color banding and identification, such as flow arrows, naming, and numbering, in accordance with the Contract Documents.

3.04 GENERAL APPLICATION REQUIREMENTS

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Coat metal unless specified otherwise:
 - 1. Aboveground piping to be coated shall be empty of contents during application of coatings.
- C. Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.
- D. Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.
- E. Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacturer's recommended special primer.
- F. Prime shop-primed metal surfaces. Spot prime exposed metal of shop-primed surfaces before applying primer over entire surface.
- G. Multiple coats:
 - 1. Apply minimum number of specified coats.
 - 2. Apply additional coats when necessary to achieve specified thicknesses.
 - 3. Apply coats to thicknesses specified, especially at edges and corners.
 - 4. When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
 - 5. Lightly sand and dust surfaces to receive high-gloss finishes, unless instructed otherwise by coating manufacturer.
 - 6. Dust coatings between coats.
- H. Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.
- I. Remove spatter and droppings after completion of coating.
- J. Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.
- K. Plural component application: Drums shall be premixed each day. All gauges shall be in working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to ensure set time is complete prior to each application. Hardness testing shall be performed after each application.
- L. Spray application:
 - 1. Stripe coat edges, welds, nuts, bolts, and difficult-to-reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.

2. When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray application.
3. Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
4. Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.

M. Drying and recoating:

1. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
2. Limit drying time to that required by these Specifications or coating manufacturer's instructions.
3. Do not allow excessive drying time or exposure, which may impair bond between coats.
4. Recoat epoxies within time limits recommended by coating manufacturer.
5. When time limits are exceeded, abrasive blast clean and de-gloss clean prior to applying another coat.
6. When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces that cannot be abrasive blasted, coat components before attachment.
7. Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
8. Touch-up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
9. Leave no holidays.
10. Sand and feather in to a smooth transition and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to the naked eye.

N. Concrete:

1. Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

3.05 ALKALI-RESISTANT BITUMASTIC

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply in accordance with general application requirements and as follows:
 - a. Apply at least 2 coats, 8 to 14 mils DFT each.

3.06 WAX COATING

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply in accordance with general application requirements and as follows:
 - a. Apply at least 1/32-inch thick coat with 2-inch or shorter bristle brush.

- b. Thoroughly rub coating into metal surface with canvas covered wood block or canvas glove.

3.07 HIGH SOLIDS EPOXY SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP 5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 10.
 - b. Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP 10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 6.
 - c. Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP 7.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2-coat system with minimum total DFT of 12 mils.
 - b. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
 - c. Coat metal to be submerged before installation when necessary, to obtain acceptable finish, and to prevent damage to other surfaces.
 - d. Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
 - e. Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

3.08 HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Prepare concrete surfaces in accordance with general preparation requirements.
 - b. Touch up shop-primed steel and miscellaneous iron.
 - c. Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
 - d. Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.
 - e. Lightly sand (de-gloss) fiberglass and PVC pipe to be coated and wipe clean with dry cloths, or solvent clean in accordance with coating manufacturer's instructions.
 - f. Abrasive blast clean ductile iron surfaces.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply a 3-coat system consisting of:

- 1) Primer: 4 to 5 mils DFT high solids epoxy.
 - 2) Intermediate coat: 4 to 5 mils DFT high solids epoxy.
 - 3) Topcoat: 2.5 to 3.5 mils DFT aliphatic or aliphatic-acrylic polyurethane topcoat.
2. Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.

3.09 POLYMORPHIC POLYESTER RESIN SYSTEM

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
2. Prepare concrete to obtain clean, open pore with exposed aggregate in accordance with manufacturer's instructions.
3. Prepare ferrous metal surfaces in accordance with SSPC SP 5, with coating manufacturer's recommended anchor pattern.
4. Complete abrasive blast cleaning within 6 hours of applying prime coat. Dew point shall remain 5 degrees above dew point 8 hours after application of coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 5.
5. When handling steel, wear gloves to prevent hand printing.
6. Adjust pH of concrete to within 5.5 to 8.0 before applying prime coat.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum DFT system consisting of primer, tie coat and top coat in accordance with manufacturer's instructions as follows:
 - 1) Steel: 35 mils.
 - 2) Concrete: 45 mils.

3.10 HIGH-TEMPERATURE COATING

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast surface in accordance with SSPC SP 10.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply number of coats in accordance with manufacturer's instructions.

3.11 ASPHALT VARNISH

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2 coats.

3.12 PROTECTIVE COAL TAR

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation of coal-tar requirements.
- B. Application:
 - 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 20 mils DFT coating.

3.13 COAL-TAR EPOXY

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast iron or steel surfaces to be coated as submerged metal in accordance with SSPC SP 5. Prepare other metal surfaces to be coated with coal-tar epoxy in accordance with epoxy manufacturer's instructions.
- B. Application:
 - 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Waterproofing outside surfaces of concrete structures: Apply minimum 2 coats with total DFT of 40 mils.
 - b. Apply 2 coats of 8 mils each for a total 16 mils DFT.
 - c. Apply coal-tar epoxy on blasted steel on same day that steel is blasted.
 - d. Apply succeeding coats over previous coat as soon as application does not cause sagging, within the following times, or as recommended by the coating manufacturer, whichever is sooner.

Average Temperature Degrees (Fahrenheit)	Maximum Time Between Coats (Hours)
50 to 60	36
60 to 70	24
70 to 80	12
80 to 120	4

- e. Apply additional coats required to obtain specified thickness.
- f. When previous coat has cured or set, or Maximum Time Between Coats has lapsed, abrasive blast previous coat until surface film is removed. Wash and clean surface with cleaning solvent. Apply succeeding coat within Maximum Time Between Coats or as recommended by coating manufacturer, whichever is sooner.
- g. When succeeding coat is applied over previous coat that has cured or set, or Maximum Time Between Coats has lapsed, and surface has not been abrasive blasted, remove entire coating system to substrate, and apply new coating system.
- h. Where coating system is applied to exterior concrete surfaces below grade, extend system at least 3 inches above finish grade in straight level.

Step extended system down 3 inches when extended system reaches 6 inches above finish grade.

3.14 COAL-TAR EPOXY SUBSTITUTE

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements and in accordance with the coating manufacturer's printed instructions.
- B. Application:
 - 1. Apply 2 coats at 6 mils to 8 mils each, for a minimum total DFT of 12 mils.

3.15 VINYL ESTER

- A. Preparation:
 - 1. Prepare surfaces in accordance with coating manufacturer's recommendations and as directed and approved by coating manufacturer's representative.
- B. Application:
 - 1. Apply prime coat, as required by coating manufacturer, base coat, glass mat, and topcoat to total dry film thickness of 125 mils minimum:
 - a. Final topcoat on floors shall include non-skid surface, applied in accordance with manufacturer's instructions.
 - 2. Perform high-voltage holiday detection test in accordance with NACE SP0188, over 100 percent of coated surface areas to ensure pinhole-free finished coating system.
 - 3. All work shall be accomplished in strict accordance with coating manufacturer's instructions and under direction of coating manufacturer's representative.

3.16 ELASTOMERIC POLYURETHANE (100 PERCENT SOLIDS)

- A. Preparation:
 - 1. Prepare surfaces in strict accordance with coating manufacturer's instructions and as directed and approved by coating manufacturer's representative.
- B. Application:
 - 1. Apply epoxy primer at DFT of 1 to 2 mils, in strict accordance with manufacturer's instructions.
 - 2. Apply polyurethane coating at minimum total DFT as follows:
 - a. Steel: 60 mils DFT.
 - b. Ductile iron and ductile iron pipe coating and lining: 30 mils DFT.
 - c. Concrete: 120 mils DFT.
 - d. Or as recommended by the coating manufacturer and accepted by the Engineer.
 - 3. For concrete application, provide saw cutting for coating terminations in strict accordance with manufacturer's instructions.
 - 4. Perform high voltage holiday detection test in accordance with NACE SP0188, over 100 percent of coated surface areas to ensure pinhole free finished coating system.

3.17 CONCRETE FLOOR COATINGS

- A. Preparation:
 - 1. Prepare surfaces in accordance with general application requirements and in strict accordance with coating manufacturer's instructions.
- B. Application:
 - 1. Apply primer if required by coating manufacturer.
 - 2. Apply 1 or more coats as recommended by coating manufacturer to receive a minimum total DFT of 25 mils; color as selected by the Owner.
- C. Final topcoat shall include non-skid surface, applied in strict accordance with coating manufacturer's instructions.

3.18 WATERBORNE ACRYLIC EMULSION

- A. Preparation:
 - 1. Remove all oil, grease, dirt, and other foreign material by solvent cleaning in accordance with SSPC SP 1.
 - 2. Lightly sand all surfaces and wipe thoroughly with clean cotton cloths before applying coating.
- B. Application:
 - 1. Apply 2 or more coats to obtain a minimum DFT of 5.0 mils.

3.19 FIELD QUALITY CONTROL

- A. Each coat will be inspected. Strip and remove defective coats, prepare surfaces, and recoat. When approved, apply next coat.
- B. Control and check DFT and integrity of coatings.
- C. Measure DFT with calibrated thickness gauge.
- D. DFT on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gauge or PosiTector® 6000.
- E. Verify coat integrity with low-voltage sponge or high-voltage spark holiday detector, in accordance with NACE SP0188. Allow Engineer to use detector for additional checking.
- F. Check wet film thickness before coal-tar epoxy coating cures on concrete or nonferrous metal substrates.
- G. Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:
 - 1. Notify Engineer 24 hours in advance of each visit by coating manufacturer's representative.
 - 2. Provide Engineer with a written report by coating manufacturer's representative within 48 hours following each visit.

3.20 SCHEDULE OF ITEMS NOT REQUIRING COATING

- A. General: Unless specified otherwise, the following items do not require coating:
1. Items that have received final coat at factory and are not listed to receive coating in field.
 2. Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
 3. Buried or encased piping or conduit.
 4. Exterior concrete.
 5. Galvanized steel wall framing, galvanized electrical conduits, galvanized pipe trays, galvanized cable trays, and other galvanized items:
 - a. Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
 - 1) Clean damaged areas by SSPC SP 1, SP 2, SP 3, or SP 7 as required.
 - 2) Apply 2 coats of a galvanizing zinc compound in strict accordance with manufacturer's instructions.
 6. Grease fittings.
 7. Fiberglass ducting or tanks in concealed locations.
 8. Steel to be encased in concrete or masonry.

3.21 SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

- A. In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 15075.
- B. The following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Verify questionable surfaces.
- C. Concrete:
1. High solids epoxy:
 - a. Safety markings.
 2. Concrete floor coating:
 - a. The coating system for the polymer tote storage secondary containment and fill station shall be as follows:
 - 1) Surface Preparation:
 - a) All new concrete shall be cured for a minimum of 28 days prior to performing any surface preparation.
 - b) Remove all grease, oil, dirt, duct, mold, mildew, and other soluble contaminant by High Pressure Water Cleaning (min. 3,500 psi, 3 to 5 gallons per minute).
 - c) Abrasive blast all concrete vertical walls to remove all laitance, curing compounds, and hardeners to provide a surface profile equivalent to a minimum ICRI CSP 5(SSPC-SP13). The floor must meet a surface profile of a minimum ICRI CSP 3 (SSPC-SP13).
 - d) Apply Tnemec Series 218 MortarClad (or equal) to all vertical surfaces @ 1/16 inch to fill all bugholes, voids, and build a monolithic surface to be coated.

- e) Follow any floor cracks with a grinding disc (1/4 inch wide), grind a 1/2 inch deep groove. Make sure the groove is cleaned out, apply Tnemec Series 215 Surfacing Epoxy (or equal) with a putty knife or trowel, filling the groove and feathering out to nothing onto the surfaces on both sides of the groove.
 - f) All surfaces must be clean and dry prior to the application of any coatings.
- 2) Coating System for Bare Concrete:
- a) Prime: Apply (1) coat of:
 - (1) Tnemec Series 201 Epoxoprime @ a rate of 6.0 – 10.0 mils DFT.
 - (2) Or equal.
 - b) Base Coat: Apply (1) coat of:
 - (1) Tnemec Series 237SC-RCK @ a rate of 8.0 – 12.0 mils DFT.
 - (2) Or equal.
 - c) Fiberglass Mat: Immediately imbed:
 - (1) Tnemec Series 211-0215 SC Mat into Base Coat.
 - (2) Or equal.
 - d) Saturant Coat: Apply (1) coat of:
 - (1) Tnemec Series 237SC-RCK @ a rate of 8.0 – 12.0 mils DFT.
 - (2) Or equal.
 - e) Top Coat: Apply (1) coat of:
 - (1) Tnemec Series 280 Tneme-Glaze @ a rate of 6.0 – 10.0 mils DFT.
 - (2) Or equal.
- 3) The High Performance Coating System must exceed a minimum 65.0 mils DFT

D. Metals:

- 1. Alkali-resistant bitumastic:
 - a. Aluminum surfaces to be placed in contact with wood, concrete, or masonry.
- 2. High solids epoxy and polyurethane system: Interior and exterior non immersed ferrous metal surfaces including:
 - a. Doors, doorframes, ventilators, louvers, grilles, exposed sheet metal, and flashing.
 - b. Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
 - c. Motors and motor accessory equipment.
 - d. Drive gear, drive housing, coupling housings, and miscellaneous gear drive equipment.
 - e. Valve and gate operators and stands.
 - f. Structural steel including galvanized structural steel.
 - g. Crane and hoist rails.
 - h. Exterior of tanks and other containment vessels.
 - i. Mechanical equipment supports, drive units, and accessories.
 - j. Pumps not submerged.
 - k. Degritters, grit classifiers, frames, supports, and associated equipment.
 - l. Other miscellaneous metals.
 - m. Grit separation and washer, frames, supports, and associated equipment.

3. High solids epoxy system:
 - a. Field priming of ferrous metal surfaces with defective shop-prime coat where no other prime coat is specified; for non-submerged service.
 - b. Bell rings, underside of manhole covers and frames.
 - c. Sump pumps and grit pumps, including underside of base plates and submerged suction and discharge piping.
 - d. Chlorine diffuser supports.
 - e. Exterior of submerged piping and valves other than stainless steel or PVC piping.
 - f. Submerged pipe supports and hangers.
 - g. Stem guides.
 - h. Vertical shaft mixers and aerators below supports.
 - i. Other submerged iron and steel metal unless specified otherwise.
 - j. Interior surface of suction inlet and volute of submersible influent pumps. Apply coating prior to pump testing.
 - k. Submerged piping.
 - l. Exterior of influent pumps and influent pump submerged discharge piping.
 4. Asphalt varnish:
 - a. Underground valve boxes.
 5. Protective coal tar:
 - a. Underground pipe flanges, excluding pipe, corrugated metal pipe couplings, flexible pipe couplings and miscellaneous underground metals not otherwise specified to receive another protective coating.
- E. Fiberglass and PVC pipe surfaces:
1. Waterborne acrylic emulsion:
 - a. Exterior of fiberglass ducting and fan housings.
 - b. Fiberglass expose to sunlight.
 - c. PVC piping exposed to view.
 - d. ABS piping as determined by Design Engineer.

END OF SECTION

SECTION 11246

POLYMER BLENDING AND FEED EQUIPMENT-LIQUID

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for provision of 2 complete and operational automatic polymer blending and feed systems to handle dilution of concentrated liquid polymer and delivery of activated polymer for waste activated sludge dewatering using belt filter presses. Provide a skid-mounted vendor supplied control panel for each polymer system and all drivers and controllers necessary for a complete and operational automated dewatering polymer solution system. Refer to mechanical and instrumentation drawings for additional requirements.
- B. Coordinate with the Belt Filter Press manufacturer to integrate the polymer blending and feed equipment as specified herein and in Section 11362.
- C. The other elements of the dewatering polymer solution system include the following and will be furnished and installed by the CONTRACTOR:
 - 1. Two bulk liquid polymer storage totes.
- D. Tag numbers:
 - 1. PDS-01: Westside Regional Polymer Dilution Skid System 1.
 - 2. PDS-02: Westside Regional Polymer Dilution Skid System 2.
 - 3. PDS-03: Westside Regional Polymer Dilution Skid System 3 (Future Unit).
 - 4. PDS-04: Westside Regional Polymer Dilution Skid System 4 (Future Unit).
- E. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the MANUFACTURER and the installing Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 01010 - Summary of Work.
 - b. Section 01600 - Product Requirements
 - c. Section 01756 - Testing, Training, and Facility Start-Up.
 - d. Section 01782 - Operation and Maintenance Data.
 - e. Section 09960 - High-Performance Coatings.
 - f. Section 15050 - Common Work Results for Mechanical Equipment.
 - g. Section 15958 - Mechanical Equipment Testing.
 - h. Section 16405 - Electric Motors.
 - i. Section 16485 - Variable Frequency Drives.
 - j. Section 17000 - Instrumentation and Controls.

- F. Inclusion of a specific manufacturer's name in the Specifications does not mean that the specific manufacturer's standard product will be acceptable. Specified manufacturer's or other manufacturer's standard product shall be modified as required to meet the Specifications.

1.02 REFERENCES

- A. CSA International (CSA).
- B. National Electrical Manufacturers Association (NEMA):
 - 1. 250 - Enclosures for Electrical Equipment (1000 V Maximum).
- C. Underwriters Laboratories, Inc. (UL).

1.03 DEFINITIONS

- A. NEMA:
 - 1. NEMA Type 4 enclosure in accordance with NEMA 250.
 - 2. NEMA Type 4X enclosure in accordance with NEMA 250.

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Provide 2 integrated polymer blending units capable of automatically metering, diluting, blending, activating, and feeding liquid polymer and water. Activate concentrated emulsion polymer in a multi-zone hydro-mechanical or hydraulic mixing vessel with a tapered mixing regime.
 - 2. Provide a NEMA 4X FRP skid mounted control panel for each polymer blending unit (2 in total) and all drivers, controllers, and microprocessors necessary for a complete and operational automated system. The polymer system control panel shall be programmed and provided by the manufacturer of the polymer blending units in accordance with these specifications. Coordinate with Belt Filter Press manufacturer as necessary.
 - 3. Under automatic control, the dewatering polymer blending system shall be capable of producing and maintaining a setpoint dilute polymer solution concentration through ratio control at a rate sufficient to meet the demands of each belt filter press downstream. There will be one polymer blending system dedicated for each belt filter press.
- B. Pre-assemble and shop-test system to ensure compliance with pressure, operational, and controls requirements.
- C. Design criteria:
 - 1. Dewatering Polymer System:
 - a. Sludge type: Waste Activated Sludge.
 - b. Polymer type: Emulsion.
 - c. Neat Polymer Viscosity Range (centipoise): Up to 6,000.
 - d. Polymer activity (percent active): Up to 45.
 - e. Active polymer dose: Maximum 30 pounds per dry ton of solids.
 - f. Maximum Sludge Feed rate: 1,410 pounds per day of dry solids.
 - g. Active polymer volumetric consumption (design flow):
 - 1) Westside Regional WRF: 1 - 6 gallons per hour.
 - h. Final percent solution desired: Normally 0.25 with a range up to 0.5.

- i. Percent solids of waste activated sludge feed: 0.6.
 - j. Polymer injection location: Sludge feed lines on suction side of the existing double-disk sludge feed pumps.
 - k. Anticipated backpressure: 5 to 15 psig.
2. Dilution Water:
- a. Dilution water shall be non-potable water. Blending systems shall be suitable for this dilution water.
 - b. Dewatering:
 - 1) Dilution water flow rate range: 200 to 2,200 gallons per hour.
 - c. Minimum consistent water pressure available for dilution water is 30 psig:
 - 1) For polymer systems relying on higher than available working differential pressures for dilution water, manufacturer must provide integral, skid mounted booster pumps and appurtenances as a part of a fully operational, pre-packaged system:
 - a) Pressure regulating valve with stainless steel, liquid filled pressure gauges to monitor and control the pressure from the booster pump.
 - b) Booster pump to be controlled by polymer blending unit and must be able to fit in area indicated on the Drawings without any interferences or changes to the specified system.
 - 2) Pressure regulating valves with stainless steel, liquid filled pressure gauges shall be provided to protect systems against over-pressure from varying dilution water pressure.
3. Neat Polymer Metering Pump:
- a. General:
 - 1) Each blender unit shall have 1 progressive cavity neat polymer metering pump integrally mounted on the system skid in a configuration that provides access and is easy to maintain.
 - 2) All motors shall meet the requirements of Section 16405.
 - 3) All variable frequency drives, if provided, shall meet the requirements of Section 16485.
 - b. Size:
 - 1) Type: Progressive Cavity.
 - 2) Minimum output range: 1 - 6 gallons per hour.
 - 3) Minimum pump motor requirements: 1/2 horsepower, 1,750 revolutions per minute:
 - a) 480 VAC inverter duty TEFC wash down motor for pumps requiring variable frequency drives.
 - b) Otherwise, 90 VDC, TEFC wash down motor.
4. Mixing motor (if hydro-mechanical mixer is used):
- a. All motors shall meet the requirements of Section 16405.
 - b. All variable frequency drives, if provided, shall meet the requirements of Section 16485.
 - c. Dewatering:
 - 1) Minimum 0.5 horsepower, 480 VAC inverter duty or 90 VDC, 1,750 revolutions per minute, TEFC, wash down motor.
 - 2) Alternatively, if variable frequency drive is not required, minimum 1 horsepower, 480 VAC, TEFC, wash down duty, 3,450 rpm.

1.05 SUBMITTALS

- A. Submit as specified in Section 15050 and 01330.
- B. Submit motor information as required per Section 16405.
- C. Product data:
 - 1. Submit data completely describing product, including plan and section views, and listing of all components and materials of construction.
 - 2. Hydrostatic level transmitter information.
- D. Shop drawings:
 - 1. Submit detailed specifications and shop drawings with both isometric and orthogonal views of the proposed installation, including dimensions, weights, and complete parts list.
 - 2. Submit wiring, control schematics, and control logic diagrams for all electrical and control components furnished.
 - 3. Submit hydraulic characteristics of the mixer.
 - 4. Submit polymer system local control panel layout, bill of materials, wiring diagrams, and associated cut sheets.
 - 5. Submit process flow schematic of the skid mounted system.
- E. Manufacturer's Qualifications: Submit all information proving conformance with manufacturer's qualifications requirements.
- F. Manufacturer's installation instructions:
 - 1. Installation and checkout instructions including lubrication and initial start-up procedures.
 - 2. Do not install equipment until all installation instructions have been supplied.
- G. Operations and Maintenance Manuals: As specified in Section 01782.
- H. Warranties.
- I. Certificates.
- J. Technician Qualifications Resume: Submit resume of technician to perform polymer system adjustments, inspections, performance testing, and training.
- K. Training Course Outline.

1.06 QUALITY ASSURANCE AND CONSIDERATION OF ALTERNATIVES

- A. Polymer Blending Unit Manufacturer Qualifications:
 - 1. Manufacturer must have at least 10 years' experience in the design, application, and supply of polymer blending systems of the type described in this Specification for the municipal wastewater market. Manufacturer shall provide a signed affidavit stating conformance with these requirements.
 - 2. Manufacturer must provide references for at least 10 currently operating installations of equipment of the same type as that to be provided under this project at municipal wastewater treatment plants in the United States.

- B. System to be pre-assembled and shop-tested to assure compliance with the pressure, operational, and control requirements, as specified in Section 01756 and Section 15050.
- C. Components and installation shall comply with the Uniform, Standard and National Building and Fire Codes.
- D. Certifications: Furnish affidavit from polymer blending unit manufacturer stating that the polymer feed systems have been tested and ready for installation as specified in Section 01756.
- E. BFP MANUFACTURER shall assume system responsibility by proper coordination with the manufacturer of the Polymer Blending Units as described herein.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 01600 - Product Requirements.

1.08 WARRANTY

- A. The complete polymer blending units shall be covered by a minimum 2 year warranty against defects in materials and workmanship:
 - 1. Warranty period shall commence after on-site acceptance (after successful start-up and testing) of equipment by the Owner.
 - 2. The polymer blending mixing chamber shall be warranted for 2 years to be free of defects in workmanship or materials:
 - a. The polymer blending mixing chamber shall be warranted against failure due to mixing chamber plugging for any reason.
 - b. If the mixing chamber plugs a replacement mixing chamber will be provided at no cost to the Owner.
 - c. This extended warranty shall not apply if the damage is caused by freezing or other weather related damage or over-pressure.
 - d. Mixing chamber motors and seals shall be covered under the system warranty rather than this lifetime warranty.
 - 3. The warranty shall apply regardless whether potable or non-potable water is used for the dilution water.

1.09 MAINTENANCE

- A. As specified in Section 15050.
- B. Provide:
 - 1. One (1) complete set of special tools needed to assemble, disassemble, and clean the system.
 - 2. Other spare parts as recommended by system supplier.

PART 2 PRODUCTS

2.01 POLYMER BLENDING UNIT MANUFACTURERS

- A. One of the following only, no substitutions or equal:
 - 1. USGI PolyBlend, appropriate model.
 - 2. VeloDyne, appropriate model.
 - 3. Acrison, appropriate model.
 - 4. Approved Equal.

- B. For manufacturers to be considered as "Approved Equal", submit all documentation to the Owner as per Specification 01600, Section 1.05.E, 20 days prior to the bid date for review and approval.

2.02 IDENTIFICATION

- A. Identify each unit of equipment with a corrosion resistant nameplate, securely affixed in a conspicuous place:
 - 1. Nameplate information to include equipment model number, serial number, manufacturer's name, and location.

2.03 MATERIALS

- A. General:
 - 1. Turbine and shaft of mechanical mixers shall be Brass or Type 316 stainless steel:
 - a. Impellers constructed of other materials are not acceptable.
 - 2. Mixing chamber shall be constructed of clear Lexan or acrylic.
 - 3. Neat Polymer Check Valve:
 - a. Body shall be constructed of stainless steel, PVC or Teflon with Viton seals.
 - b. Valve poppet and spring shall be stainless steel.
 - 4. Brass, bronze, or stainless steel mixing chamber pressure or neat polymer pump relief valve and drain valve.
 - 5. System shall be constructed with a Type 316 stainless steel chassis.
 - 6. Hardware shall be Type 316 stainless steel.
 - 7. Piping and valves shall be Schedule 80 PVC.
 - 8. Hose shall be braided vinyl and hose fittings shall be Schedule 80 PVC. Nylon fittings are not acceptable.
 - 9. Any other components in contact with polymer or water shall be constructed of brass, stainless steel or an inert plastic.

2.04 EQUIPMENT

- A. Mixing requirements:
 - 1. Mixing energy shall be provided by a stainless steel or bronze mixing impeller or through a non-mechanical hydrodynamic blending device:
 - a. For systems with hydro-mechanical mixers:
 - 1) Mixing impellers shall be designed to produce both axial and radial flow.
 - 2) Plastic impellers are not acceptable.
 - 3) The volume of mixing chamber shall be 1.0 gallon minimum to provide sufficient residence time for polymer activation.

- b. Systems relying on differential hydraulic pressure for mixing shall be designed to provide necessary mixing energy with a dilution water pressure of 30 psig above the mixing chamber discharge pressure. If additional pressure is required systems shall be supplied with integral dilution water booster pumps as specified in Article 1.04 of this Section.
2. Mixing system shall be specifically designed to invert, disperse, and activate in solution emulsion polymers with viscosities up to 6,000 cps and active contents up to 45 percent.
3. The mixing system shall be designed to effectively induce high, non-damaging mixing energy over the system's full flow range.

B. Mixing chamber:

1. Mixing chamber shall be made of a suitable clear composite material such as Lexan, polycarbonate, or acrylic to view the mixing action and blending effectiveness.
2. Mixing chamber shall provide two stage mixing. The initial high energy mixing zone shall prevent fisheye formation with a G-value of 14,000 sec⁻¹ (if applicable), followed by the low energy mixing zone with G-value of lower than 3,500 sec⁻¹ (if applicable) to minimize fracturing hydrated polymer molecules.
3. Mixing chamber shall have a minimum rated pressure of 100 pounds per square inch.
4. Provide a stainless steel, brass, or bronze mixing chamber pressure relief valve and drain valve.
5. All bearings shall be external from the mixing chamber.
6. Neat polymer check valve:
 - a. Specifically designed to isolate neat polymer from dilution water.
 - b. Readily accessible for cleaning without the use of tools.
 - c. Installation inside the mixing chamber not allowed.
 - d. Mixing chamber disassembly for access not allowed.
 - e. Conventional ball type check valves, valves that rely on ball seals, and/or check valves installed inside the mixing chamber, or which require mixing chamber disassembly for servicing not allowed.

C. Dilution water system:

1. The dilution water will be provided as follows:
 - a. Owner will provide non-chlorinated UV-disinfected dilution water for the dewatering polymer system via the in-plant reclaimed service water system. Each polymer blending unit shall include an adjustable pressure regulator to maintain water flow and pressure to the necessary system pressure.
2. The plant reuse water will meet the Florida regulations for public access reuse and will have total suspended solids (TSS) less than 5 mg/L.
3. The dilution water shall have primary mixing and post-dilution (as part of the manufacturer's skid mounted unit, as applicable based on the polymer blending unit manufacturer) to expedite polymer activation by maximizing the value of breaker surfactant present in emulsion polymer, as per the AWWA Standard for Polymers (ANSI/AWWA B453-06).
4. Primary water flow shall supply the mixing chamber to make higher polymer solution concentration (0.5 percent - 1.0 percent optimum). Secondary water flow shall be used to post dilute the activated polymer solution to feed concentration (as part of the manufacturer's unit. These two streams shall be completely blended by a static mixer prior to exiting the polymer system.

5. The dilution water inlet assembly for each unit shall be ANSI 150 lb flange connection.
6. The common dilution water supply line shall have a 40 mesh strainer unit, furnished and installed by the installing Contractor.
7. Each polymer blending unit shall include:
 - a. A motorized ball valve for open/close control of dilution water.
 - b. A separate linear actuated flow control valve for automatic modulation of dilution water flow in response to the ratio controller.
 - c. The dilution water flow rate shall be monitored by a magnetic flow meter that meets the requirements of Section 17000 whichever is applicable. Downsize the flowmeter size as needed for the accurate flow range with appropriate reducer fittings as recommended by the Polymer skid supplier.
 - d. The flow meter shall provide the dilution water flow rate to the ratio controller.
 - e. Unions or flanges shall be provided on the inlet and outlet of the flowmeter to allow easy removal for cleaning or inspection.
 - f. A 2-inch stainless steel liquid filled pressure gauge to monitor dilution water inlet pressure. The pressure gauge shall read from 0 to 160 psig. Pressure gauges shall meet additional requirements as specified in Section 17000.

D. Solution discharge system:

1. Pressure gauge:
 - a. Size: 2-inch.
 - b. Materials: Type 316 stainless steel.
 - c. Liquid filled with diaphragm seal.
 - d. The pressure gauge shall read from 0 to 160 psig.
 - e. Pressure gauges shall meet additional requirements as specified in Section 17000.
2. Check valve:
 - a. Type: Flapper or diaphragm.
 - b. Materials: PVC and Viton.
 - c. Size: Same size as the solution discharge piping.

E. System skid:

1. Frame:
 - a. Material: Type 316 stainless steel:
 - 1) Constructed of minimum 3/16-inch angle or structural stainless steel tubing.
 - 2) Mild steel not accepted.
 - b. Design: Easy access to all components.
2. All piping rigidly supported with stainless steel supports.
3. The skid shall include anchoring locations for mounting to concrete equipment pads.

F. Neat polymer metering pump:

1. General:
 - a. Each blender unit shall have 1 progressive cavity neat polymer metering pump integrally mounted on the system skid in a configuration that provides access and is easy to maintain:
 - 1) Systems shall not exceed the footprint shown on the Drawings.

- b. Manufacturers: Moyno, or Seepex, (appropriate model) no equal.
- c. Materials of Construction:
 - 1) Type 316 stainless steel for all wetted components.
 - 2) Viton stators.
 - 3) Stuffing box and seal type as recommended by polymer blending and feed equipment manufacturer for neat polymer service.
- d. Each pump shall conform to the requirements herein, and mechanical requirements of Section 15050.
- e. Capable of pumping polymer with apparent viscosities of up to 6,000 cps.
- f. Metering pumps shall be capable of accurately metering the specified neat liquid polymers.
- g. Pump capacity adjustments shall give accurate and repeatable flows within 5 percent of calibrated values, and shall be free of drift during operation.
- h. Gear reducers shall be provided to produce a maximum pump shaft speed of not more than 350 rpm.
- i. Provide thermal flow switches for each pump to shut down due to run dry condition. Thermal flow switch shall be as recommended by the pump supplier and provide necessary relay, wirings, etc. in the Vendor Supplied Control Panel.
- j. Controllers:
 - 1) SCR motor controllers or VFDs located in the vendor supplied control panel.

G. Accessories:

- 1. For each blender unit, provide a calibration column sized and calibrated for 1 minute of drawdown at the maximum pump rate.
 - a. Graduation:
 - 1) Increments read in both mL and gph.
 - b. Construction: Clear polyvinyl chloride.
 - c. Configuration:
 - 1) Nipple and plug for system operation without cylinder.
 - 2) Full port PVC ball valves having Viton O-rings:
 - a) Locate 1 ball valve on the discharge of the calibration column.
 - b) Locate 1 ball valve on the neat polymer inlet pipe up stream of the calibration column discharge valve.
 - d. Assembly:
 - 1) Furnished and rigidly installed on polymer system skid.
 - 2) Use of piping for support is not acceptable.
- 2. For each blender unit, provide a polymer flow sensor to monitor the metering pump rate and protect the pump from running dry:
 - a. Polymer flow sensor:
 - 1) Meter polymer flow based on the progressing cavity meter pump rotational speed. Include a thermal switch in the stator of the meter pump to serve as a low polymer flow switch.
 - 2) Mount on system skid with Type 316 stainless steel bracket.
- 3. For each blender unit, provide pressure relief valve:
 - a. Materials: PVC and Viton.
 - b. Location: Discharge line of the pump.
 - c. Factory plumbed back to suction of the pump.

4. Pressure gauge:
 - a. Size: 2-inch.
 - b. Materials: Type 316 stainless steel.
 - c. Liquid filled with diaphragm seal.
 - d. Location: Discharge line of the pump.
 - e. The pressure gauge shall read from 0 to 160 psig.
 - f. Pressure gauges shall meet additional requirements as specified in Section 17000.

2.05 CONTROLS

- A. Polymer blending unit manufacture shall coordinate with the Belt Filter Press Manufacturer and the Instrumentation System Supplier and provide all necessary assistance.
- B. General:
 1. The polymer blending unit manufacturer's standard control packages shall be modified to provide the controls described herein.
 2. Dewatering Polymer Solution System:
 - a. Provide a skid mounted control panel for each polymer blending unit for control of the dewatering polymer blender units based on signals from the Plant SCADA system.
 - b. The control panel enclosure and all electrical and instrumentation components shall conform to the requirements stated in the Contract Documents.
 - c. Control panels and all components shall be UL listed and labeled.
 - d. Under AUTO control, the dewatering polymer solution system shall accept a polymer solution concentration setpoint and shall maintain that setpoint through ratio control. The system shall operate to produce the same volume of polymer solution as the volume used in the dewatering process by accepting a sludge flow and a TSS meter signal from the Plant PLC system, calculating the incoming mass of dry solids in tons and maintaining a flowrate which meets an operator selected polymer dose rate in pounds of polymer per dry tons of incoming solids.
 - e. System shall include instruments to sense loss of dilution water. Upon sensing that dilution water flow has been interrupted, system shall place the neat polymer pump on standby and annunciate a common fail alarm. The system shall restart the neat polymer pump automatically when flow is restored.
 - f. System shall include instruments to sense loss of polymer flow. Upon sensing that polymer flow has been interrupted, system shall stop and annunciate a common fail alarm. A manual local reset of the alarm condition will be required before the system can resume operation.
 - g. The controller/PLC in the control panel shall be pre-programmed from the factory by the manufacturer's software programmer.
- C. Dewatering Polymer Solution System Vendor Supplied Control Panels (VCP):
 1. Enclosures and control panel features:
 - a. Each VCP shall be powered from a 480 volt, 20 amp, 3-phase, 60 hertz power supply:
 - 1) Provide main breaker rated 20 amp, 480 volt, 3-phase with external handle disconnect.

- 2) The panel shall have 18kAIC rating for fault current.
 - 3) Provide control power transformers as required for any other required voltages. Size control power transformers according to the actual loads.
 - 4) Provide 480 volt, 3-phase surge protection device wired to protect motors and control equipment from lightning induced line surges.
- b. Components:
- 1) The controller/PLC and VFD (or SCR) unit shall be either mounted in a vendor supplied control panel or in two separate panels. Provide UPS for controller/PLC system. Each panel shall be provided with all necessary din-rail, switches, LED indication lights, relays, wiring, etc. for a complete and functional system.
 - 2) Front panel controls:
 - a) Provide in accordance with Section 17000 and as shown on instrumentation drawings.
 - b) Provide an emergency stop pushbutton.
 - c) System HAND/OFF/AUTO.
 - d) 1-turn potentiometer - mixer speed (if polymer solution system is supplied with a variable speed mixer).
 - e) 10-turn potentiometer - progressive cavity metering pump control, unless VFD controller is adjustable at the VCP without needing to open the panel.
 - f) Booster pump HAND/OFF/AUTO switch (if applicable and provided by the MANUFACTURER). If booster pump is needed, provide NEMA starter in the vendor control panel.
 - g) Main power ON light/Running Indication.
 - h) LCD display:
 - (1) Metering pump rate.
 - (2) Water flow rate.
 - (3) Solution concentration, if applicable.
 - i) Low water low water flow alarm light:
 - (1) Metering pump goes to stand-by mode when low dilution water flow occurs. The pump automatically restarts when flow returns. Should the water flow not return within adjustable time delay, the system stops and requires manual reset.
 - j) Low polymer flow alarm light:
 - (1) When low/loss of polymer flow occurs, the system stops and requires manual restart. An adjustable time delay relay shall be provided to prevent nuisance alarms from occurring.
 - k) Solution concentration fault light:
 - (1) When solution concentration is outside of the acceptable range, the PLC will stop the system and require manual restart. An adjustable time delay shall be provided to prevent nuisance alarms from occurring
 - 3) Remote monitoring and control as shown on drawings and as describes herein:
 - a) Provide dry relay contact outputs for the following:
 - (1) System running.
 - (2) In AUTO mode.

- (3) Common fail alarm:
 - (a) Alarm condition shall be annunciated upon Loss of Level signal, Loss of Polymer Flow, Low Water Flow, or Solution Concentration Fault.
 - b) Accept discrete inputs for the following:
 - (1) Start/stop.
 - c) Provide 4-20mA outputs for the following:
 - (1) Neat Polymer pump speed feedback (if VFD is used).
 - (2) Polymer Dilution System water flow rate.
 - (3) Polymer Dilution System Calculated pump flow rate.
 - d) Accept 4-20mA inputs for the following:
 - (1) Polymer Solution Concentration Setpoint:
 - (a) Single setpoint shall be used to control either duty or standby unit.
 - (2) Polymer Pump Speed Command (if VFD is used).
 - c. Enclosure and associated components:
 - 1) In accordance with Section 17000 unless otherwise specified in this Section.
 - 2) NEMA Type 4X fiberglass reinforced plastic.
 - 3) Provide main disconnect handle.
 - 4) Provide a manual thermal magnetic circuit breaker to disconnect power from each motor installed within VCP.
 - d. Panel shall be skid-mounted:
 - 1) The control panel shall be skid mounted and will not accept external stand-alone control panel to be mounted away from the skid. Provide components necessary to assure adequate cooling.
 - e. Mixing chamber motor:
 - 1) Motor starter.
 - f. Neat polymer pump motor:
 - 1) Motor starter.
 - 2) SCR controllers or VFDs:
 - g. All components of each polymer blending unit shall be pre-wired to each control panel by the manufacturer. This includes motors, instruments, and ancillary devices.
 - h. Neat Polymer Pump protection:
 - 1) Supply each pump with self-contained pump protection components as follows.
 - 2) 120 VAC, 1-phase, power supply.
 - 3) Wired directly to the internal pump monitoring devices, including:
 - a) Stator thermal switches.
 - b) Motor temperature switch.
 - 4) Provide the following output contacts:
 - a) Stator thermal switches.
 - b) Motor temperature switch.
- 2. Control Description:
 - a. The Belt Filter Press manufacturer in coordination with the polymer blender manufacturer and the instrumentation Contractor(as necessary) shall provide all necessary controls/programming to provide the functionality described herein.

- b. The system shall be provided with LOCAL /REMOTE operating modes:
 - 1) LOCAL: In local manual mode, the neat polymer pump speed, the polymer dilution water pump and water flow rate shall respond to manual input at the vendor control panel.
 - 2) REMOTE: In remote mode the system shall accept remote start/stop dry contacts and 4-20 mA polymer solution concentration setpoint signal.
- c. Under Remote Mode:
 - 1) The polymer activation unit shall provide activated polymer solution at a setpoint solution concentration to continuously maintain a dose setpoint based on analog sludge flow and TSS transmitter signals from the plant PLC system.
 - 2) The solution concentration shall be maintained at a constant setpoint percentage using a microprocessor-based or PLC-based ratio control algorithm. In the remote mode the solution concentration set point shall be adjustable via a 4-20mA signal from the Plant SCADA system. Once the system is sent a start command, the system shall send polymer directly into the belt filter press feed manifold.
 - 3) The solution flow rate shall be variable to maintain a constant setpoint dosage in pounds of polymer per dry tons of incoming solids to the belt filter press. The polymer blending unit shall calculate this flow rate based on incoming flow and TSS signals. In the remote mode, the polymer dose shall be adjustable via a 4-20mA signal from the Plant SCADA system.

2.06 SOURCE QUALITY CONTROL

- A. Witnessing: Source or factory testing shall be witnessed by the Engineer or the Owner when scheduled; provide advanced notice of source testing. All travel expenses for the witnessing party shall be covered by the Manufacturer.
- B. Variable frequency drive and motor factory tests: Test as specified in the variable frequency drive section.
- C. Hydrostatic pressure tests: As specified for components in this Section.

PART 3 EXECUTION

3.01 EXAMINATION

- A. As specified in Section 15050.

3.02 INSTALLATION

- A. Polymer blending units shall be installed and programmed with adequate coordination with the Belt Filter Press manufacturer in strict conformance with the manufacturer's installation instructions and with favorable review shop drawings. Contractor and his instrumentation subcontractor shall be fully responsible and lead all necessary coordination with the manufacturers.

- B. Checkout of final installation, start-up, calibration, and instruction of operating personnel shall be performed by an authorized representative of the polymer blending unit manufacturer:
 - 1. Manufacturer shall provide Certificate of Proper Installation in accordance with Section 01756.
- C. Alignment of piping may vary from that indicated on the Drawings:
 - 1. Upon acceptance by the Engineer, align piping to suit the equipment furnished, without additional cost to the Owner.
- D. Installing Contractor to flush out reuse water line until water discharged from line is clear and free of debris.
- E. Installing Contractor to avoid exposing neat polymer lines to water at any point of the system.

3.03 FIELD COATING

- A. Pumps, piping, valves, and accessories: Field coat as specified in Section 09960.

3.04 TESTING

- A. Functional testing of the entire polymer feed system to be conducted following installation and cleaning of the polymer blending units. Contractor shall take the lead and responsibility to coordinate with the manufacturers as described below.
- B. Testing to be conducted by the polymer blending unit manufacturer's representative, Belt Filter Press manufacturer's Representative in coordination with the installing Contractor in the presence of the OWNER and Engineer to demonstrate that equipment is capable of performing its specified function in a satisfactory manner without mechanical or electrical defects, binding, or operational difficulties.
- C. Excessive vibration or noise shall be corrected, as specified in Section 15050.
- D. Installing Contractor shall verify and affirm that all connections are watertight.
- E. Accuracy of all polymer feed components shall be demonstrated and brought within the limits specified in this Section.
- F. During testing, installing Contractor shall make all final adjustments necessary to place equipment in satisfactory working order.
- G. Belt Filter Press manufacturer's representative in coordination with the polymer blending unit manufacturer's representative and the installing Contractor shall test and calibrate all controls, switches, automatic valves, and other instrumentation and control equipment associated with the polymer feed system specified, in accordance with the manufacturer's printed instruction over the full operating range of the equipment.
- H. Provide certified test report as specified in Section 01756.
- I. Coordinate testing with functional testing of other sludge dewatering equipment.

3.05 POLYMER BLENDING UNIT MANUFACTURER'S FIELD SERVICES

- A. Coordinate field service work with the Belt Filter Press manufacturer, installing Contractor, the Owner, and Engineer prior to initiating such work.
- B. Require Polymer Blending Unit Manufacturer's Representative to perform the following services as described below and as specified in Section 01756. The specified durations are the minimum required time on the jobsite. Additional services and/or longer durations shall be provided as needed at no cost to the Owner to meet the required quality of work:
 - 1. Dewatering Polymer Solution System:
 - a. Installation Assistance: 1 workday.
 - b. Installation Inspection: 1 Workday.
 - c. Start-up/Testing Assistance: 2 Workdays.
 - d. Training per Section 01756 and as further described below: 16 hours:
 - 1) Operations Training: 8 hours.
 - 2) Mechanical Maintenance Training: 6 hours.
 - 3) Electrical Maintenance Training: 2 hours.
 - e. Final Acceptance and Checkout: 1 Workday.
 - f. Post Start-up Field Visit: 1 Workday.
- C. Additional Training Requirements:
 - 1. The Contractor shall coordinate with the Belt Filter Press manufacturer and the Polymer Blending Unit manufacturer and shall submit a training course outline plan one month before training starts, with proposed class material and class schedule to the Owner for approval. Training will begin only if the class material and class schedule have been reviewed and approved by the Owner.
 - 2. Training will begin only after the dewatering system has successfully passed the performance test, has been started-up for at least one belt filter press, and has provided beneficial use to the Owner.
 - 3. Subjects of instruction shall include the following:
 - a. Start-up and shutdown procedures.
 - b. Troubleshooting.
 - c. System operation.
 - d. Operating adjustments for performance optimization.
 - e. Preventative mechanical and electrical maintenance.
 - f. Removal and replacement of system components.
 - g. Mechanical and electrical maintenance procedures.
 - h. Emergency procedures.
 - i. Record keeping.
 - j. Mechanical unit function and description.
 - k. Variable frequency drives and SCR controllers.
 - l. System controls.

3.06 DEMONSTRATION

- A. Provide system start-up as specified in Section 01756.

END OF SECTION

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SECTION 11313

HORIZONTAL SPLIT-CASE CENTRIFUGAL WASHWATER PUMPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Split-case centrifugal pumps with drivers and components for Belt Filter Press washwater application.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 01140 - Construction Sequence.
 - b. Section 01600 - Product Requirements.
 - c. Section 01756 - Testing, Training and Facility Start-up.
 - d. Section 01782 - Operating and Maintenance Data.
 - e. Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
 - f. Section 09960 - High-Performance Coatings.
 - g. Section 15050 - Common Work Results for Mechanical Equipment.
 - h. Section 15958 - Mechanical Equipment Testing.
 - i. Division 16 - Electrical.

1.02 REFERENCES

- A. American Bearing Manufacturers Association (ABMA):
 - 1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11 - Load Ratings and Fatigue Life for Roller Bearings.

- B. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
 - 2. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.

- C. ASTM International (ASTM):
 - 1. A 48 - Standard Specification for Gray Iron Castings.
 - 2. A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
 - 3. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 4. A 283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 5. A 322 - Standard Specification for Steel Bars, Alloy, Standard Grades.
 - 6. A 532 - Standard Specification for Abrasion-Resistant Cast Irons.

7. A 536 - Standard Specification for Ductile Iron Castings.
 8. A 582 - Standard Specification for Free-Machining Stainless Steel Bars.
 9. A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 10. B 505 - Standard Specification for Copper Alloy Continuous Castings.
 11. E 10 - Standard Test Method for Brinell Hardness of Metallic Materials.
 12. F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 13. F 594 - Standard Specification for Stainless Steel Nuts.
- D. Hydraulic Institute (HI):
1. 1.1-1.2 - Centrifugal Pumps for Nomenclature and Definitions.
 2. 1.3 - Rotodynamic (Centrifugal) Pumps for Design and Application.
 3. 1.6 - Centrifugal Pump Tests.
 4. 9.1-9.5 - Pumps - General Guidelines for Types, Definitions, Application, and Sound Measurement and Decontamination.

1.03 DEFINITIONS

- A. Pump head (total dynamic head, TDH), flow capacity, pump efficiency, net positive suction head available (NPSHa), and net positive suction head required (NPSHr): As defined in HI 1.1-1.2, 1.3, 1.6, and 9.1-9.5 and as modified in this Section.
- B. Flow, head, efficiency, and driver horsepower specified in this Section are minimums unless stated otherwise.

1.04 SYSTEM DESCRIPTION

- A. Split-case centrifugal pumps with components: Pump, driver, motors, and drive arrangements as scheduled with seals or packing, couplings, base plates, guards, supports, anchor bolts, necessary valves, gauges, taps, lifting eyes, stands, and other items as specified and as required for a complete and operational system.
- B. Pumps suitable for intermittent or continuous service with up to 10 milligrams per liter residual chlorine concentration.
- C. Pumps will draw suction from a gravity plant reuse water main supplied with 39 ft of static head from the vertical chlorine contact chamber and will maintain the pressure at the BFP spray bars at around 100 psi.
- D. Design requirements:
1. Pump performance characteristics:
 - a. As specified in the Pump Schedule.
 - b. Performance tolerances shall be the same as the test tolerances specified in Section 15958.
 2. Motor characteristics: As specified in the Pump Schedule.

1.05 SUBMITTALS

- A. Submit as specified in Section 15050.
- B. Torsional analysis: Submit as specified in Section 15050 when scheduled.

- C. Furnish motor submittals as specified in Division 16.
- D. Submit training materials.
- E. Submit field testing procedures.
- F. Manufacturer's Representatives qualifications as specified in Section 01756.
- G. Provide vendor operation and maintenance manual as specified in Section 01782.

1.06 QUALITY ASSURANCE

- A. As specified in Section 15050.
- B. Provide pumps in this Section from same manufacturer.
- C. Manufacture's Certificate of Installation and Functionality Compliance as specified in Section 01756.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 15050.

1.08 PROJECT CONDITIONS

- A. Environmental requirements: As required by the federal, state, and local regulatory agencies.

1.09 SEQUENCING AND SCHEDULING:

- A. Coordinate work with restrictions as specified in Section 01140.
- B. Coordinate work with Start-up /Check-out as specified in Section 01756.

1.10 WARRANTY

- A. Warranty:
 - 1. The Manufacturer shall provide a five (5)-year warranty on defects in materials and workmanship.
 - 2. The Warranty period shall start from the date of Substantial Completion and also meet the Contractor's General Warranty as defined in Contract General Conditions.
 - 3. The Contractor shall provide an executed copy of the warranty upon Substantial Completion as defined in Contract General Conditions.

1.11 MAINTENANCE

- A. Special tools: For each type or size of pump specified, manufacture shall provide 1 set of all special tools required for complete assembly or disassembly of all pump system components.
- B. Provide spare parts as recommended by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Pumps:
 - 1. Goulds Pumps, model as scheduled.
 - 2. No substitutions.

2.02 MATERIALS

- A. General: Materials in the Pump Schedule shall be the type and grade as specified in this Section.
- B. Cast iron: ASTM A 48, Class 30 minimum.
- C. Hi-chrome cast iron: ASTM A 532, Class III, Type A at 450 Brinell hardness.
- D. Ductile iron: ASTM A 536, Grade as scheduled.
- E. Bronze or leaded tin bronze: ASTM B 505, Alloy C92700.
- F. Type 304 stainless steel: ASTM A 276, Type 304 stainless steel.
- G. Type 316 stainless steel: ASTM A 276, Type 316 stainless steel or ASTM A 666, Type 316 stainless steel.
- H. Type 416 stainless steel: ASTM A 582, Type 416 stainless steel.
- I. Steel: ASTM A 108, Grade as scheduled.
- J. Hot-wrought alloy steel: ASTM A 322, Grade 4140, UNS Alloy G41400.
- K. Structural steel: ASTM A 283, Grade D.
- L. Neoprene: Polychloroprene rubber.

2.03 GENERAL PUMP CONSTRUCTION

- A. Type: Industrial (heavy) duty, split-case pumps meeting performance and design requirements and features as specified in this Section.
- B. Fasteners: Provide Type 316 stainless steel fasteners per ASTM F 593 and ASTM F 594.

2.04 PUMP CASINGS

- A. Type: Axially split case; allow removal of rotating element without disturbing piping connections or alignment; mounted horizontally or vertically as scheduled.
- B. Material: As scheduled.
- C. Construction: Of sufficient strength, weight, and thickness to provide accurate alignment and prevent excessive deflection.

- D. Design working pressure: Minimum 1.10 times maximum shutoff total dynamic head with maximum installable impeller diameter at maximum operating speed plus maximum suction static head.
- E. Hydrostatic test: 5-minute hydrostatic test minimum 1.5 times design working pressure.
- F. Casing assembly: Lifting eye bolts for removable half and doweling to facilitate alignment of bolted halves.
- G. Suction and discharge: Single suction as scheduled; piping connections in lower half of casing with side entry and exit unless otherwise indicated on the Drawings.
- H. Suction and discharge piping connections: Flanged, meeting ASME B16.1, Class 125, or ASME B16.5, Class 150, or higher pressure class as required to meet design working pressure.
- I. Vent and taps:
 - 1. Provide casings with bolt 3/4-inch threaded high-point and low-point drain taps.
 - 2. Provide 1/2-inch threaded tap with valve and pressure gauge on the suction and discharge flanges.

2.05 IMPELLERS

- A. Type: As scheduled.
- B. Material: As scheduled.
- C. Maximum number of vanes: As scheduled.
- D. Design with smooth water passages to prevent clogging by stringy or fibrous materials. Passages shall be capable of passing solids with sphere size as scheduled.
- E. Design impeller and volute for automatic unattended self-priming and repriming with a dry suction leg and without reliance on a suction check valve to maintain prime.
- F. Design impeller with integral pump out vanes on the back shroud.
- G. Method of securing to shafts: Threaded or Keyed and secured by bronze nut locked in place, but readily removable without use of special tools.
- H. Adjustment of axial clearance: Through jacking screws and lock nuts placed between frame and outboard bearing housing or by shims held in place by frame housing.
- I. Rotation: Clockwise looking from top, unless otherwise indicated on the Drawings.
- J. Balance: As specified in Section 15050 to meet vibration criteria as specified in Section 15958.

2.06 WEAR RINGS

- A. Impeller wear-ring material:
 - 1. When low lead bronze impeller is scheduled, provide bronze alloy meeting the requirements of NSF 61 and 372.
 - 2. When bronze impeller is scheduled, provide UNS Alloy C93200 wear ring.
 - 3. When zincless-bronze impeller is scheduled, provide UNS Alloy C93700 wear ring.
 - 4. When cast-iron impeller is scheduled, provide ASTM A48, Class 30 cast-iron wear ring.
 - 5. When stainless steel impeller is schedule, provide Stainless Steel ASTM A276 CD4MCU wear ring.
 - 6. Impeller wear ring shall have a Brinell Hardness Number at least 50 less than the casing wear ring Brinell Hardness Number when tested in accordance with ASTM E10.
- B. Casing wear-ring material: Same material as impeller wear ring.
- C. Features:
 - 1. Able to allow compensation for minimum 1/8-inch wear.
 - 2. Removable.
 - 3. Fastened with recessed screws or keyed to casing to prevent relative rotation.

2.07 SHAFT

- A. Material:
 - 1. When low lead bronze impeller is scheduled, provide bronze alloy meeting the requirements of NSF 61 and 372.
 - 2. When bronze impeller scheduled, provide ASTM A582, Type 416 stainless steel shaft.
 - 3. When zincless-bronze impeller scheduled, provide ASTM A276, Type 316 stainless steel shaft.
 - 4. When cast-iron impeller scheduled, provide ASTM A108, Grade 1141 steel shaft.
 - 5. When stainless steel impeller is schedule, provide Stainless Steel ASTM A276 Type 316 stainless steel shaft.
- B. Strength: Able to withstand minimum 1.5 times maximum operating torque and other loads.
- C. Resonant frequency: As specified in Sections 15050 and 15958.
- D. Deflection: Maximum 0.002 inches under operating conditions.
- E. Impeller attachment: Threaded on.
- A. Shaft sleeve:
 - 1. When low lead bronze impeller is scheduled, provide bronze alloy meeting the requirements of NSF 61 and 372.
 - 2. When bronze impeller scheduled, provide ASTM B505, UNS Alloy C93200 shaft sleeve.
 - 3. When zincless-bronze impeller scheduled, provide ASTM A276, Type 316 stainless-steel shaft sleeve.

4. When cast-iron impeller scheduled, provide ASTM A582, Type 416 stainless-steel shaft sleeve.
 5. When stainless steel impeller is schedule, provide Stainless Steel ASTM A276 Type 316 stainless steel shaft.
- B. Renewable, key locked or set screws in stuffing box, gland area, and bearings; able to protect shaft from pumped liquid and wear.
- C. Pump shaft seal:
1. Single, Cartridge.
 2. Carbide rotating and silicon stationary seal faces.
 3. Viton elastomers.
 4. Stainless steel cage and spring.
 5. Stuffing box shall be integral to the suction casing.

2.08 BEARING

- A. Bearing type: Anti-friction in accordance with ABMA standards; self-aligning spherical roller type radial bearings; angular contact ball type, or tapered roller for thrust bearings.
- B. Bearing lubrication:
1. Provide oil lubrication:
 - a. Separate oil reservoir type system.
 - b. External level indicator gauge.
 2. Size sufficiently to safely absorb heat energy normally generated in bearing under maximum ambient temperature of 60 degrees Celsius.
- C. Bearing life: Minimum L10 life of 100,000 hours at rated design point but not less than 24,000 hours in accordance with ABMA 9 or 11 at bearing design load imposed by pump shutoff with maximum-sized impeller at rated speed, whichever provides longest bearing life in intended service.
- D. Pump bearing frames:
1. 1-piece rigid construction with bearing housing at outboard (pump) end and at inboard (driver) end.
 2. Materials:
 - a. Pump bearing frame: ASTM A48, Class 30 minimum, cast iron.
 - b. Bearing housing and end cover: ASTM A48, Class 30 minimum, cast iron.
- E. Bearing frame drain hole: Tapped, located as low as possible to drain leakage when adjacent to packing or seal.

2.09 SHAFT STUFFING BOX

- A. Provide stuffing box suitable for shaft-seal type scheduled and as specified in Section 15050.
- B. Seal flushing: Use pumped fluid; pipes and passages by pump manufacturer with external replaceable filter, pressure-regulating device, seal-flush pressure gauge (with shutoff valve), and site flow indicator.

2.10 COUPLINGS

- A. Type: As scheduled, and as specified in Section 15050.
- B. Flexible coupling life: Infinite at up to 0.3-degree misalignment angle total or per disk for disk type at maximum operating loads.
- C. Design coupling to withstand a minimum of 1.5 times the maximum operating torque and other imposed loads.

2.11 SUPPORTS, PEDESTALS, AND BASEPLATES

- A. Materials: Same as pump casing or ASTM A 283 steel, hot-dip galvanized after fabrication and coated as specified in Section 09960.
- B. Pump and driver support strength: Able to withstand minimum 1.5 times maximum imposed operating loads or imposed seismic loads, whichever is greater.
- C. Configuration: Allow easy access to stuffing boxes, bearing frames, and couplings.
- D. Design a structural steel base and support system for the drive arrangement specified in this Section and as schematically indicated on the Drawings.
- E. Anchor bolts: As specified in Section 05190.

2.12 EQUIPMENT GUARDS

- A. Provide equipment safety guards as specified in Section 15050.

2.13 DRIVERS

- A. Horsepower:
 - 1. As scheduled.
 - 2. Listed driver horsepower is the minimum to be supplied:
 - a. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.
 - b. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.
 - c. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.
- B. Motors: Provide motors as specified in Division 16 and as specified in this Section:
 - 1. Revolutions per minute: As scheduled.
 - 2. Enclosure: As scheduled.
 - 3. Electrical characteristics: As scheduled.
 - 4. Efficiency, service factor, insulation, and other motor characteristics: As specified in Division 16.
 - 5. Motor accessories: As specified in Division 16 and in this Section.
 - 6. Motor shall be premium efficiency as per Division 16.

2.14 FINISHES

- A. Pump manufacturer to factory prime and coat pump/motor and discharge elbow as specified in Section 09960.
- B. Contractor to provide touch-up field coatings as specified in Section 09960.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be as indicated on the Drawings, in accordance with written instructions of the manufacturer, and as specified in Section 15050.

3.02 COMMISSIONING AND PROCESS START-UP REQUIREMENTS

- A. As specified in Section 01756 and this Section.
- B. Manufacturer services:

Source Testing (Witnessed or Non-witnessed)	Manufacturer Rep Onsite							
	Training Requirements		Installation Testing		Functional Testing		Process Operational Period	
	Maintenance (hrs per session)	Operation (hrs per session)	Trips	Days (each trip)	Trips	Days (each trip)	Trips	Days (each trip)
Non-Witnessed	2	2	1	1	1	1	24 hour on-call	

- C. Source Testing:
 - 1. Pump:
 - a. Test witnessing: As scheduled and as specified in Section 01756.
 - b. Performance test: Test level as scheduled; test as specified in Section 15958.
 - c. Vibration test: Test level as scheduled; test as specified in Section 15958.
 - d. Noise test: Test level as scheduled; test as specified in Section 15958.
 - 2. Pump casing: Hydrostatic pressure tests if specified in this Section.
 - 3. Motor: Test as specified in Division 16.
- D. Functional Testing:
 - 1. Pump assembly:
 - a. Performance test: Test level as scheduled; test as specified in Section 15958.
 - b. Vibration test: Test level as scheduled; test as specified in Section 15958.
 - c. Noise test: Test level as scheduled; test as specified in Section 15958.
 - 2. Motor: Test as specified in Division 16.

3.03 PUMP SCHEDULE

Tag Numbers	WW-PMP-01, WW-PMP-02
<u>General Characteristics:</u>	
Service	Belt Filter Press Washwater (using plant reclaimed Water)
Total Suspended Solids in washwater	≤ 5 mg/L
Residual chlorine in washwater	2 - 5 ppm (average)
Quantity	2
First Named Manufacturer's Model Number	3196 STi
Torsional Analysis	Not Required
Minimum Pumped Fluid Degrees Fahrenheit	50
Normal Pumped Fluid Degrees Fahrenheit	70
Maximum Pumped Fluid Degrees Fahrenheit	85
<u>Pump Characteristics:</u>	
Impeller Type	Open
Impeller, Maximum Number Vanes	5
Shaft Seal Type	Single Mechanical
Coupling Type	Spacer
Speed Control	None
Maximum Pump revolutions per minute	1800
Pump Size	1x1.5-8
<u>Rated Design Point:</u>	
Flow, gallons per minute	120
Minimum Suction Head available, feet	12
Additional Discharge Head required, feet	231
Minimum Efficiency, percent	55
<u>Other Conditions:</u>	
Shut Off Head, feet	255
Maximum NPSHr at Every Specified Flow, feet	7.9
Minimum Suction Static Head, feet (see note 1)	0.5
Maximum Suction Static Head, feet (see note 1)	0.8
<u>Pump Materials:</u>	
Pump Casing	Ductile Iron
Impeller	316 Stainless
Shaft	316 Stainless

Tag Numbers	WW-PMP-01, WW-PMP-02
Stuffing Box	Cast Iron
Seal Water connection and solenoid valve	Yes
<u>Driver Characteristics:</u>	
Driver Type	Motor
Drive Arrangement	Horizontal, Coupled
Minimum Driver Horsepower	20
Maximum Driver Speed, revolutions per minute	3600
<u>Motor Characteristics (when motor is driver type):</u>	
Inverter Duty Rated	No
Motor Voltage/Phases/Hertz	460/3/60
Enclosure Type	TEFC
120VAC Space Heater	Yes
Motor Winding Thermostat	Yes
<u>Source Testing:</u>	
Test Witnessing	Not Witnessed
Performance Test Level	2
Vibration Test Level	None
Noise Test Level	None
<u>Functional Testing:</u>	
Performance Test Level	2
Vibration Test Level	1
Noise Test Level	1
<u>Notes:</u>	
1. Pump will draw water from a 10-inch gravity reuse water main with 39ft of static head to supply washwater from the old vertical chlorine contact chamber. This static head will be constant.	

END OF SECTION

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SECTION 11362

BELT FILTER PRESS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for belt filter press (BFP) systems for dewatering waste activated sludge complete with auxiliary equipment, and control panels.
- B. The Contractor and his Instrumentation Controls subcontractor shall furnish the BFPs and associated local control panels, including programming of the local control panels. The Contractor shall coordinate with the manufacturers of the shaftless screw conveyors, and the polymer blending units. After completion of the project, the Contractor shall provide laminated panel wiring diagrams (11x17) inside each new local control panel related to belt filter press units. Panel wiring diagrams shall incorporate the red-line mark-ups during the start-up and testing phase. Wiring diagrams without including the red-line mark-ups will be rejected and will need to recreate them without additional cost to the Owner.
- C. The Contractor shall provide BFP local control panel (LCP) as shown on Instrumentation drawings and as described in this specification. Refer to Instrumentation communication block diagram for anticipated network connection between belt filter press LCP's, conveyor control panels, and a BFP master control panel (PCP-DW).
- D. Related sections:
 - 1. Section 01010 - Summary of Work.
 - 2. Section 01330 - Submittal Procedures.
 - 3. Section 01600 - Product Requirements.
 - 4. Section 01756 - Testing, Training, and Facility Start-Up.
 - 5. Section 01782 - Operation and Maintenance Data.
 - 6. Section 11246 - Polymer Blending Units.
 - 7. Section 14555 - Shaftless Screw Conveyors.
 - 8. Division 15 - Mechanical.
 - 9. Division 16 - Electrical.
 - 10. Division 17 - Instrumentation and Control.
- E. Tag numbers:
 - 1. WR-BFP-01 - Dewatering BFP No. 1.
 - 2. WR-BFP-02 - Dewatering BFP No. 2.
 - 3. WR-BFP-03 - Dewatering BFP No. 3 (Future).
 - 4. WR-BFP-04 - Dewatering BFP No. 4 (Future).
 - 5. LCP-BFP1 - BFP#1 Local Control Panel.
 - 6. LCP-BFP2 - BFP#2 Local Control Panel.
 - 7. LCP-BFP3 - BFP#3 Local Control Panel (Future).
 - 8. LCP-BFP4 - BFP#4 Local Control Panel (Future).

1.02 REFERENCES

- A. American Bearing Manufacturer's Association (ABMA):
 - 1. 11 - Load Ratings and Fatigue Life for Roller Bearings.

- B. American Society of Mechanical Engineers (ASME):
 - 1. B36.19 - Stainless Steel Pipe.

- C. ASTM International (ASTM):
 - 1. A36 - Standard Specification for Carbon Structural Steel.
 - 2. A48 - Standard Specification for Gray Iron Castings.
 - 3. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. A242 - Standard Specification for High-Strength Low-Alloy Structural Steel.
 - 5. A276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 6. A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - 7. A320 - Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
 - 8. A519 - Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing.
 - 9. D394 - Method of Test for Abrasion Resistance of Rubber Compounds.
 - 10. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - 11. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 12. D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
 - 13. D638 - Standard Test Method for Tensile Properties of Plastics.
 - 14. D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
 - 15. D789 - Standard Test Methods for Determination of Solution Viscosities of Polyamide (PA).
 - 16. D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 17. D2240 - Standard Test Method for Rubber Property-Durometer Hardness.
 - 18. D2294 - Standard Test Method for Creep Properties of Adhesives in Shear by Tension Loading (Metal-to-Metal).
 - 19. D2632 - Standard Test Method for Rubber Property-Resilience by Vertical Rebound.
 - 20. D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

- D. International Organization for Standardization (ISO).

- E. National Electrical Manufacturers Association (NEMA):
 - 1. 250 - Enclosures for Electrical Equipment (1000 V Maximum).

- F. Society for Protective Coatings (SSPC):
 - 1. 10 - Near-White Blast Cleaning.

- G. Underwriters Laboratories, Inc. (UL).

1.03 DEFINITIONS

- A. NEMA Type 4X enclosure in accordance with NEMA 250.

1.04 SYSTEM DESCRIPTION

- A. Description of sludge to be fed to belt press:
1. Type of sludge: Waste activated sludge from 5-stage Bardenpho process.
 2. Feed solids: 0.5 to 1.0 percent.
 3. Volatile suspended solids: 78 to 85 percent.
 4. pH range: 5 - 8 with normal pH range of 6.5 to 7.5.
 5. Sludge temperature: 50 to 95 degrees F with normal range of 65-75 degrees Fahrenheit.
 6. Suitable for sludge containing the following trace compounds: Hydrogen sulfide, nitrogen, carbon dioxide, and methane gas.
 7. Operation: Designed to operate continuously.
- B. Performance requirements: As a minimum, each belt filter press shall be capable of operating at the following conditions with piping, pumping, and auxiliary systems rated for a higher hydraulic capacity when operating in accordance with project conditions and under normal sludge feed conditions specified above.

Hydraulic feed rate (sludge only)	
Maximum	425 gallons per minute (@ 0.6 percent inlet solids concentration)
Design	275 gallons per minute (@ 0.6 percent inlet solids concentration)
Minimum	200 gallons per minute (@ 0.6 percent inlet solids concentration)
Solids feed rate	
Maximum	1,410 lbs/hour at inlet solids of 0.6%
Design	840 lbs/hour at inlet solids of 0.6%
Minimum	580 lbs/hour at inlet solids of 0.6%
Belt washwater	120 gpm
Belt washwater pressure	120 psi minimum
Active polymer dosage	Maximum 30 pounds polymer/ton dry solids of the polymer currently used by the Owner. Coordinate with the Owner for polymer selection and optimization.
Belt life	2,000 hours of operation minimum
Minimum Percent Dry Solids	16
Solids capture	Minimum 95 percent

- C. The belt filter press shall have the maximum dimensions, 117 inches high, 268 inches long, and 142 inches wide. The overall static weight of the belt filter press shall not exceed 30,000 pounds so as to minimize installation and civil work.

- D. The minimum clearance requirements specified herein shall not relieve the BFP MANUFACTURER and the installing Contractor from allowing additional clearances for the proper installation, operation, and maintenance of the units. The Contract Drawings show a general layout. Contractor in coordination with the BFP MANUFACTURER shall be fully responsible to take field measurements before fabrication of the BFPs to prepare a proper layout to provide sufficient access for operation and maintenance.

1.05 SUBMITTALS

- A. Submit as specified in Section 01330 - Submittal Procedures.
- B. Product data: As specified in Section 15050 - Common Work Results for Mechanical Equipment.
- C. Shop drawings: As specified in Section 15050 - Common Work Results for Mechanical Equipment:
 - 1. Submit "draft" standard shop drawings within 30 days of award of the contract.
 - 2. Include additional details on belt filter press, conveyors, polymer blending units, motors, gear drives, hydraulic system, control panel layouts, schematic wiring diagrams and interconnections wiring diagrams, interconnecting piping, pipe supports, and size and length of each support frame member.
 - 3. Details of the discharge deflection plate including dimensions and details for operator access to and operation of the scraper blades.
- D. Calculations: As specified in Section 15050 - Common Work Results for Mechanical Equipment:
 - 1. Structural anchor points to concrete foundation.
 - 2. Distribution of stresses through belt filter press frame.
 - 3. Seismic loads on frame and anchor bolts.
 - 4. Member deflection.
 - 5. Maximum roller deflection.
 - 6. Roller bearing compliance bearing life requirement at maximum loading, based on ABMA/ISO capacity formula.
 - 7. Roller factor of safety calculations at maximum loading conditions.
 - 8. Roller maximum deflection calculations at maximum loading conditions.
- E. Vendor operation and maintenance manuals: As specified in Section 01782 - Operating and Maintenance Data.
- F. Quality assurance submittals:
 - 1. Resume of technician for start-up and training services.
 - 2. BFP MANUFACTURER's references.
- G. Electrical drawings showing the belt filter press unit wiring, routing of conduits at the unit, and locations of all unit mounted electrical and instrumentation equipment, motors, and terminal junction boxes. Include termination wiring diagram identifying manufacturer terminations and customer terminations for power, signal and control.
- H. Schematic process & Instrumentation diagram of actual system to be supplied.

- I. Software and Programming:
 - 1. Provide electronic copy of the PLC program (operating software) and all software used to program the BFP PLC, and all non-PLC software (all proprietary software as applicable).
 - 2. Provide hard copies or electronic pdf files of all programming and parameters stored within the PLC.
 - 3. Control logic descriptions and narrative for the intended operation of the supplied unit and the actual PLC program to be loaded into the BFP PLC panel.
 - 4. Coordinate with Owner and submit HMI (Human Machine Interface) screen captures for Owner/Engineer approval and incorporate Owner/Engineer's comments. BFP local control panel HMI screen shall have all information and control relating to the associated belt filter press system.

- J. Commissioning submittals:
 - 1. Provide Manufacturer's Certificate of Source Testing as specified in Section 01756 - Commissioning.
 - 2. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01756 - Commissioning.
 - 3. Provide training course materials.

1.06 PATENTS

- A. The BFP MANUFACTURER shall warrant that the use of this system and its equipment, in the process for which the system has been expressly designed, will not infringe any U.S. or foreign patents or patents pending. In the event of any claim of infringement the manufacturer shall defend and indemnify the owner free from any liabilities associated with the use of the patented equipment or process.

- B. The BFP MANUFACTURER shall grant to the owner, in perpetuity, a paid-up license to use any inventions covered by patent or patents pending, owned, or controlled by the manufacturer in the operation of the facility being constructed in conjunction with the equipment supplied under this contract, but without the right to grant sublicenses.

1.07 DELIVERY, SHIPPING, AND HANDLING

- A. As specified in Section 01600 - Product requirements.

1.08 SCHEDULE AND SEQUENCING

- A. Coordinate with Contractor and Owner for work restrictions, scheduling constraints, and sequencing requirements.

1.09 WARRANTY

- A. General:
 - 1. BFP MANUFACTURER shall supervise any disassembly of the shipped units and reassembly of the units in place inside the dewatering building by the Contractor (as applicable). Coordinate with Contractor on this.
 - 2. Contractor shall assume full responsibility for proper installation of all equipment and provide complete warranty of the equipment and parts as described below.

- B. The following warranties shall be for each BFP:
1. Provide a standard warranty of 12 months from substantial completion (beneficial use), unless otherwise noted for individual components below.
 2. Frame and coating:
 - a. Warrant for 5 years to be free of manufacturing defects without preventative maintenance.
 - b. Defects or corrosion occurring within the 5 years to the frame shall be repaired or replaced at no cost to the Owner.
 3. Belt life:
 - a. Warrant belt life for a minimum of 2,000 hours of continuous operation at the rated design conditions.
 - b. Minimum belt life shall cover wear and belt damage due to defects in the manufacture of the press or any of its components.
 - c. Belts not meeting the running hour minimum shall be replaced at no charge; running time begins the date of project acceptance or date of first beneficial use excluding testing and start-up use.
 4. Performance:
 - a. Warrant press performance as specified.
 - b. Presses not meeting the specified performance shall provide additional belt designs or shall modify the press as necessary until the specified performance level is reached at no additional cost to the Owner.
 5. Bearings:
 - a. Warrant the bearings for 3 years from substantial completion.
 - b. Warranty shall include all parts and labor for repairing or replacing bearings that fail during the warranty period providing the Owner has properly lubricated the bearing.

1.10 SPARE PARTS AND SPECIAL TOOLS

- A. Deliver spare parts in a crate to the Owner. Include the following for the BFPs:
1. 1 set of filter belts guaranteed for 2,000 hours operating life for each press supplied:
 - a. Provide same spare belts as supplied with the presses.
 2. A complete set doctor blade (or discharge blade).
 3. 1 set of special tools and jacking tools for maintenance and belt replacement.
 4. 2 complete sets of sludge guides and rubber seals for the gravity and wedge zone.
 5. 1 set of washwater box seals and edge seals.
 6. Metric to English pipe coupling adapter for each metric drain pipe installed.
 7. Seals on drive unit.
 8. Oil filter screen for the hydraulic power unit for each press supplied.

PART 2 PRODUCTS.

2.01 MANUFACTURERS

- A. One of the following for the BFPs:
1. BDP Industries 2.0 m 3DP.
 2. Alfa Laval G3 200 Klampress 3 Belt.
 3. Andritz SMX-S8.
 4. Approved Equal.

- B. For manufacturers to be considered as “Approved Equal”, submit all documentation to the Owner as per Specification 01600, Section 1.05.E.
- C. Naming of the model number above does not relieve the Contractor from meeting the details of manufacturing requirements within this specification.
- D. For other equipment (Polymer Blending Units) and Conveyors, see specifications Sections 11246 and 14555 respectively.
- E. The BFP MANUFACTURER shall take the lead on providing system responsibility for a completed dewatering equipment and handling system.

2.02 MATERIALS

- A. Frame: ASTM A36 steel, galvanized after fabrication in accordance with ASTM A123 (hot dipped galvanized), galvanizing process shall apply zinc at a minimum thickness of 4 to 7 mils.
- B. Drain trays: ASTM A242, Type 316 stainless steel, minimum 14 gauge.
- C. Internal piping: Schedule 80 polyvinyl chloride or ASTM A312, Type 316, schedule 10S stainless steel.
- D. Spray header housing: ASTM A242, Type 316L stainless steel, minimum 14 gauge.
- E. Belt wash spray tube: ASTM A312, Type 316 stainless steel pipe, schedule 10S.
- F. Belt wash spray nozzles: Flat non-clog ASTM A276, Type 316 stainless steel.
- G. Belt wash piping: Schedule 80 PVC.
- H. In-line venturi mixer: Flanged ASTM A276, Type 316 stainless steel housing.
- I. Polymer injection device: Flanged ultra-high molecular weight polyethylene injection ring and splitter manifold.
- J. Belt filter cloth: Seamed and fabricated of monofilament polyester twill.
- K. Belt seam closures: ASTM A276, Type 316 stainless steel.
- L. Rollers (solid):
 1. ASTM A36 carbon steel, or ASTM A519 tubing, minimum 1/2 inch wall thickness with 3/4-inch end plates.
 2. Drive rollers coated with minimum 1/4-inch thick Buna-N rubber.
 3. Other solid rollers coated with 25 mils minimum of thermoplastic nylon or 1/4-inch minimum of Buna-N rubber.
- M. Rollers (perforated): ASTM A242, A276, or A312, Type 316 stainless steel, minimum 10 gauge wall thickness.
- N. Inlet distribution assembly: ASTM A242, Type 316 stainless steel, minimum 10 gauge.

- O. Side skirts: ASTM A242, Type 316 stainless steel, minimum 14 gauge with replaceable rubber or urethane seals.
- P. Plows: ASTM A242, Type 316 stainless steel holders or galvanized cast iron holders with ultra-high molecular weight polyethylene (UHMW) blades.
- Q. Plow rods: ASTM A276, Type 316 stainless steel.
- R. Belt support grid: ASTM A242, Type 316 stainless steel grid (10 gauge minimum) with replaceable ultra-high molecular weight polyethylene (UHMW) wear bars.
- S. Belt support within wedge zone: ASTM A242, Type 316 stainless steel grid with replaceable ultra-high molecular weight (UHMW) wear bars or carbon steel hot-dip galvanized frame with UHMW polyethylene wear plates or ASTM A320 Type 316 stainless steel frame with perforated polyethylene sheets.
- T. Doctor blades: Ultra high molecular weight high-density polyethylene.
- U. Discharge deflection plate: ASTM A242, Type 316 stainless steel, and minimum 1/8-inch thick or 10 gauge.
- V. Anchor bolts and miscellaneous hardware, including bolts, nuts, washers, and fastener clips: ASTM A320, Type 316 stainless steel.
- W. Non-listed miscellaneous equipment: ASTM A242 or A276, Type 316 stainless steel, nylon coated.
- X. Bearing housings: ASTM A48 Class 30 cast iron.
- Y. Structural steel plates: ASTM A36 steel, minimum 1/4-inch thick, galvanized after fabrication in accordance with ASTM A123, galvanizing process shall apply zinc at a minimum thickness of 4 to 7 mils.
- Z. Electrical junction boxes (all electrical enclosures): NEMA Type 4X, Type 316 stainless steel or FRP.
- AA. Electrical conduit: Rigid steel, PVC coated.
- BB. Hydraulic cylinders:
 1. Body: FRP tube with high strength glass filled nylon head.
 2. Rod: ASTM A 242, Type 316 stainless steel with stainless steel tie rods, teflon seals, and graphite bearing.
- CC. Roller shafts: Forged steel ASTM 572 Grade 50.
- DD. Doctor blades: UHMW polyethylene.
- EE. Hydraulic tubing: Type 316 stainless steel rigid tubing.
- FF. Note: All carbon steel surfaces to be hot dip galvanized in accordance with ASTM A123 at a minimum thickness of 3.9 mils.

2.03 GENERAL REQUIREMENTS

- A. Each belt filter press shall be a complete prefabricated unit of at least a sludge conditioning system, a gravity drainage section, a pressure section, a belt alignment and tensioning system, and a belt washing system.
- B. Each belt filter press shall have a minimum effective dewatering width of 2.0 meters with 3 dewatering zones; gravity dewatering zone, wedge zone, and the pressure/shear section zone.
- C. Effective dewatering width: Belt area in contact with sludge performing a dewatering function.
- D. Belt replacement: Design system to allow belt replacement without disassembly of machine components or changes to belt pressure or alignment settings.

2.04 STRUCTURAL

- A. Framework:
 - 1. Designed to withstand operating (belt tension of 50 pounds per lineal inch, belt speed 5 meters per minute) and static loads without deformation or vibration during operation and without exceeding specified maximum deflection with the following minimum factor of safety of < 5.0 :
 - a. Maximum load shall be based upon the summation of forces applied to the frame including but not limited to roller and bearing mass forces and tension forces.
 - 2. Welded or bolted construction. No field welding of members allowed.
 - 3. Framework surface shall be prepared for hot-dipped galvanizing in accordance with SSPC-SP-8 (pickling method) after fabrication. Galvanizing process shall apply zinc at a minimum thickness of 3.9 mils in accordance with ASTM A 123.
 - 4. Provide permanent lifting lugs.
 - 5. Load bearing members in the high pressure dewatering section:
 - a. Wide flange beams with minimum moment of inertia of 53 inches to the fourth power in the principal load-bearing direction.
 - b. Beams shall be a minimum flange thickness of 1/2 inch minimum web thickness of 5/16 inch.
 - 6. Cross members: Minimum of 3 cross members each with a minimum moment of inertia of 3.01 inches to the fourth power.
 - 7. Maximum stress in all frame members: Not more than 1/5 of the structural member's yield strength.
 - 8. Maximum deflection in each structural member: Not more than $L/480$ where L equals span length.

2.05 DRAINAGE

- A. Drain pans: General:
 - 1. Provide drainage pans and piping to collect and discharge filtrate from the gravity dewatering and pressure/shear dewatering sections.
 - 2. Extend drain pans minimum of 3 inches beyond the belt width on both sides.
 - 3. Provide minimum of 2-inch high sides all around the drain pans.
 - 4. Provide minimum 6-inch diameter flanged connection at low point for drainage piping.

5. Drain piping connection: Standard NPS American schedule pipe per ASME B36.19.
 6. Drain connections: Self-venting with flushing connections for cleaning.
 7. Drainage pan location shall not interfere with the moving belts and shall be rigidly connected to press frame.
- B. Drain pan under the entire length of the gravity zone:
1. Drainage pan(s) and discharge pipes: Designed to withdraw a minimum of 375 gallons per minute without overflowing.
 2. Designed to prevent discharge of filtrate along the wedge zone.
 3. Gravity drainage piping combined into 1 common pipe which shall extend to allow for hard piping into a common drain line.
 - a. Drain line shall be extended to within 3 inches of the floor of the sump.
- C. Drain pan(s) in wedge and pressure zones:
1. Interconnected and designed to allow for hard piping into a common drain line:
 - a. Drain line shall be extended to within 3 inches of the floor of the sump.
- D. Spray wash enclosure drain lines:
1. Drain lines from each spray wash enclosure separated from drainage pan piping and interconnected into a common drain line:
 - a. Drain line shall be extended to within 3 inches of the floor of the sump.

2.06 BELT WASH SYSTEMS

- A. Manufacturers: The following or equal:
1. Appleton Manufacturing, Menasha Corp., Menasha, WI.
- B. Design belt wash water system to use water with the following characteristics:
1. Available washwater: Non-chlorinated, UV disinfected, plant reuse water.
 2. Minimum pressure available at the connection to the press washwater piping in accordance with specified performance requirements specified in this Section.
 3. Maximum pressure available at the connection to the press washwater piping: 120 pounds per square inch gauge.
 4. Solids content: Up to 50 milligrams per liter of suspended solids.
 5. Each belt press shall be provided with a 1-1/2 inch PVC connection for belt washing.
- C. Components:
1. Upper and lower belt wash systems positioned so that washing is performed after the cake has been discharged from the belt.
 2. Pressure regulating valve: Sized to provide flow and pressure required for the belt wash system with inlet pressures as specified above.
 3. Nozzles: Replaceable, designed with a built in hand wheel operated stainless steel brush to provide cleaning action without disassembly; handwheel to extend to outside of press so brush can be operated without interruption of the belt press operation able to wash either side of the belt.
 4. Spray header housing:
 - a. Totally enclose the belt extending the full width of the belt plus 2 inches on either side.

- b. Replaceable double rubber or nylon brush seals provided where the belt enters and exits the housing to eliminate spray in the work area.
- c. Easily removable.
- 5. Spray piping and nozzles:
 - a. Braced and of sufficient pressure rating to withstand pressure caused by sudden valve closure.
 - b. Spray pattern overlaps at the belt surface.
- 6. Provide a motor operated ball valve or solenoid valve that operates the washwater system as specified.
- 7. Low water pressure switch: Adjustable, provided to shut down the belt press and actuate alarm on the local control panel on low washwater pressure.

2.07 FILTER BELTS

- A. Belt filter cloth:
 - 1. Split type continuous belt design.
 - 2. Fixed edges along belt operating surface: Chamfered.
 - 3. Belt sides: Provide 1 inch wide protective resin coating.
 - 4. Minimum effective belt width: 2.0 meters.
 - 5. Minimum belt life: 2,000 operating hours.
 - 6. Minimum overall belt width: 2.2 meters.
- B. Belt seams:
 - 1. Repairable and easily replaceable.
 - 2. Connecting splice: designed for a minimum tensile strength equal to 5 times the normal maximum dynamic tension to which the belt is subjected.
 - 3. Seam designed to fail before the belt and constructed of Type 316 stainless steel.
 - 4. Seam designed not to interfere with doctor blades or any other equipment.
- C. Belt selection:
 - 1. As recommended by the BFP MANUFACTURER obtained from experience testing the sludge during start-up and as required to meet specifications:
 - a. The supplier shall test a minimum of 2 belts.

2.08 ROLLER AND DRUM ASSEMBLIES

- A. General:
 - 1. Provide three distinct dewatering zones, independent gravity zone, wedge compression zone and high pressure-dewatering zone. Each zone shall at a minimum have the specified minimum filtration area or working area. Independent gravity zone 92 feet square, the wedge zone 94 feet square and the high pressure zone 108 feet square.
 - 2. Provide minimum 24-inch diameter perforated drum followed by a 16 inch diameter perforated roll immediately following the wedge compression zone.
 - a. Perforations shall have a minimum diameter of 1 inch.
 - 3. Following the perforated roller, the belts shall travel through a series of rollers as determined by the BFP MANUFACTURER.

- B. Rollers:
1. Construction:
 - a. Continuous shaft or double separated plate stub end shaft type with stub end shafts and roller heads welded in place.
 - b. Bolted-in-place stub end roller shafts are unacceptable.
 2. Minimum safety factor for the bending stress of the roller shafts at maximum loading as specified:
 - a. 5.0 for the pressure zone and drive rollers.
 - b. 5.0 for non-drive rollers and other rollers not in the pressure zone.
 3. Maximum loading: Based on the maximum summation of all forces applied to the roller including the forces exerted by the tension of the belts from the belt drive and belt tensioning devices (minimum of 200 pounds per lineal inch of belt width), friction forces, sludge and equipment loads, drive torque, and roller mass forces.
 4. Maximum roller deflection at maximum loading 0.05 inches at roller center:
 - a. Calculations shall include roller diameter and lengths, all shaft diameters and lengths, wall thickness, and degree of belt wrap.
 5. Rollers machined to ensure total concentricity.
 6. Pressure section roller shafts:
 - a. Minimum shaft diameter inside the roller: 5.0 inches.
 - b. Minimum shaft diameter inside the bearing journal: 2.95 inches.
 7. Perforated roller: Fitted with internal vanes to direct filtrate water to outlet ports at each end of the roller, to prevent re-wetting of the downstream cake.
- C. Roller surface preparation:
1. Mechanical pipe sandblasted per steel structures painting council SSSP-10.
 2. Outside diameter tolerance to within 0.02 inch concentricity.
 3. End plate thickness minimum 1-inch at contact with inside diameter of roller.
 4. End plates welded to roller.
 5. Following lathing process, minimum roller wall thickness shall be 0.5 inches.
 6. All roller surfaces free of pits, blemishes, depressions, and ridges.
- D. Roller coatings:
1. Drive rollers coated with minimum 1/4-inch thick vulcanized Buna-N rubber coating with a rubber hardness of Shore A 90-95.
 2. Rollers other than drive rollers: Coated with a minimum 1/4-inch thick Buna-N or 25-mil thick coating of "Rilsan" nylon.
 3. Buna-N coating properties:

Test	Value
Hardness (Shore A) (ASTM D676)	90
Hardness (Shore A) Vulcanized Buna-N	90-95
Tensile Strength (psi) (ASTM D412)	2,500
Tear Strength (pli) (ASTM D624)	250
Elongation (%) (ASTM D412)	160
Taber Wear Index (ASTM D394)	064
Resilience (%) (ASTM D2632)	17
Coefficient of friction	1-.4

Test	Value
Specific Gravity (water = 1.0)	1.31
Coefficient of Expansion (in/in/degree Fahrenheit)	40x10 ⁻⁶

4. "Rilsan" nylon coating properties:

Test	Conditions	Value
Shore D Hardness (ASTM D2240)	20 degrees C	77
Hardness Persoz (AFNORT 30-016)	Pendulum 20 degrees C	190
Specific Gravity (ASTM D792)	R Scale, 20 degrees C	1.06-1.20
Rockwell Hardness (ASTM D785)	20 degrees C, 20 sec. under load	106
Surface Hardness (DIN 53-456)	Clemen Apparatus	80 N/sq mm
Scratch Resistance (0.44 mm thickness)		59 N
Shear Strength (D 732)	RT & 45 degrees F	35 - 42 N/sq mm
Impact Resistance (ASTM D2294)		160 in-lbs
Elongation (ASTM D638)		15%
Abrasion Resistance (ASTM D4060)		8-18 mg wt loss
Coefficient of friction	Measured at thickness	0.10 - 0.30
Tensile Strength (ASTM D638)		6,000 psi
Inflammability greater than 3 mm (ASTM D635)		Self-extinguishing
Melting Point (ASTM D789)		370 degrees F

5. All rollers shall be coated up to the point of insertion into the bearing block, or shall have shafts and heads of Type 316 stainless steel.

2.09 BEARINGS

A. Roller bearings:

- All rollers supported by externally mounted, self-aligning spherical roller bearings in sealed, splashproof, and grease lubricated horizontal split case pillow block housings.
- Bearings: Attached to turned, ground, and polished shaft journals on the rollers by direct mounting using an interference fit.
- Minimum bearing L-10 life: 600,000 hours at minimum belt speed of 5 meters per minute and belt tension of 50 pounds per inch. L-10 life calculated in accordance with ABMA 11 shall be based on the summation of all forces applied to the bearings including roller mass forces, belt tension, and drive torque on the rollers.
- Bearings: Series 222 spherical bearings with minimum self-alignment capability of plus or minus 3/8 of a degree and mounted in expansion and non-expansion pillow block housings.

5. Lubrication: Required no more than every 6 months.
 6. Bearing shall be press fit to the roller shaft.
- B. Steering roller bearings:
1. Bearings: Non-self-aligning cylindrical roller bearings in pivot mounted pillow block housings.
- C. Bearing housings:
1. Housing: ASTM A48 Class 30 cast iron with minimum of 4 Type 316 stainless steel cap bolts and 2 mounting bolts.
 2. Housings cleaned, iron phosphated, and coated with a heat-treated thermoplastic nylon or Buna-N coating as specified with a minimum thickness of 8 - 12 mils.
 3. Located centrally on the structural beams with 2 mounting bolts on each side of the web.
 4. Outer side of the bearing housings: Solid without end caps or filler plugs.
- D. Bearing lubrication:
1. Bearing lubrication shall be performed through Monel® or Type 316 stainless steel buttonhead grease fittings.
 2. All bearings shall be greasable while unit is in operation.

2.10 DEWATERING ZONES

- A. Gravity dewatering zone:
1. General:
 - a. Minimum effective area of the gravity section shall be 88 square feet.
 2. Components:
 - a. Inlet distribution assembly:
 - 1) Distribute sludge evenly through a chute or distribution head box onto the horizontal section of the belt press with minimal turbulence at maximum hydraulic loading as specified in this Section.
 - 2) Provide adjustable baffles or similar devices to uniformly distribute the sludge feed across the entire working width of the filter belt.
 - b. Number of plows: Minimum of 7 rows distanced laterally across the filter belt.
 - c. Plastic row of plows provided with single lifting handle:
 - 1) Plows shall pivot to clear obstructions and move in either lateral direction to prevent belt seam damage.
 - 2) Plows designed to allow 1 inch vertical obstruction on the belt to pass under the plows without damage to the belt or plow with the plow able to return to its original position.
 - d. Side skirts: Provide side skirts with replaceable seals along both sides of the belt to contain sludge on the belt.
 - e. Belt support grid: Minimum 2 inches wider than the width of the belt spaced at a minimum of 2-1/2 inches.
 - f. Wear strips: Designed to be removable and replaceable.
 - g. Note: Vacuum assisted, inclined gravity section or gravity section that requires a separate belt drive motor are not acceptable.
 - h. The independent gravity section shall be provided with hydraulic tension and tracking system as specified in this specification. Manual tensioning or tracking systems will not be acceptable.

- B. Wedge dewatering zone:
 - 1. General:
 - a. Minimum effective filtration area of the wedge zone shall be 28 square feet (measured on one belt only).
 - b. Wedge zone:
 - 1) Low pressure dewatering stage provided to gradually increase the filtration force on the cake for dewatering without leakage of sludge cake.
 - 2) Zone consists of a wedge shaped section in which the 2 pressure belts carrying the sludge are gradually converged to form a cloth/cake sandwich.
 - 3) Wedge angle shall be adjustable between 1 and 6 inches while the belt press is in operation.
 - c. Splash guards: Provide to contain leakage from the wedge stage inside the belt press frame.
 - d. No extrusion or spillage of sludge is allowed over solids and hydraulic loadings as specified.
 - e. Maximum deflection: 0.06 inches at 2 pounds per square inch wedge pressure at mid-span.
- C. Pressure/shear section:
 - 1. General:
 - a. Minimum effective working belt area of pressure/shear stage shall be 187 square feet.
 - b. Effective working belt area: Effective width times the belt length in actual contact with the rollers.
 - c. Pressure/shear section consisting of a minimum of 8 rollers developing an "S" shaped pattern of belt travel with decreasing diameter rollers toward the cake discharge.
 - d. Pressure zone configuration: Able to remove filtrate from the sludge cake without rewetting the downstream cake.
 - e. No extrusion or spilling of sludge is allowed from the belt within the pressure/shear stage.
 - f. Sludge subjected to incremental increases in pressure without an increase in belt tension as sludge travels over decreasing diameter rollers.
 - g. The use of impervious belts or nip rollers to apply external pressure to the sludge shall not be considered acceptable.

2.11 DOCTOR BLADES AND DEFLECTOR PLATE

- A. General: Provide doctor blades and discharge deflector plate to assist the separation of cake from the belt at the point of cake discharge.
- B. Doctor blades:
 - 1. Doctor blades:
 - a. Minimum length equal to length of roller.
 - b. Blades replaceable.
 - c. Provide lifting handle to allow quick release of the doctor blade from the belt for inspection and servicing.
 - 2. Blades with adjustable counter-weighted or spring tensioned on the ends of the doctor blade to allow adjustment of the force of the doctor blade against the belt.

- C. Deflector plate:
 - 1. If necessary to access scraper blades, provide discharge deflection plate hinged to the belt press frame on both ends to allow rotation up and designed with positive clasps to hold the deflection plate in the up and down positions.

2.12 BELT TRACKING AND TENSIONING SYSTEMS

- A. General:
 - 1. Provide automatic belt tracking and tensioning systems using hydraulic control systems:
 - a. Belt tension shall be infinitely variable up to 50 pounds per inch.
 - 2. Hydraulic piping:
 - a. Type 316 stainless steel with a design working pressure 1.25 times the operating pressure, rigidly anchored to the belt press frame.
 - b. All lines sized according to use and operating pressure with a conservative factor of safety by equipment manufacturer.
 - 3. Furnish sufficient piping for installation between the hydraulic unit or the air compressor unit and the connection to the belt press with locations indicated on the Drawings.
 - 4. Hydraulic systems: Include pumps, motor starters, reservoirs, motors, gauges, filter, oil level sight glasses, temperature gauge, valves, low/high pressure sensors, piping, and controls for system operation.
- B. Belt tracking system:
 - 1. Automatic sensing devices: Continuously monitors the position of the belt by use of a spring-loaded arm fitted with a ceramic plate which rides on the edge of the belt or a rubber covered roll situated across the machine's width.
 - 2. Alignment roller: Continuously adjusts the belt position to keep the belt within the belt track.
 - 3. Designed to smoothly adjust belt position without sharp, sudden movements of the belt or alignment roller.
 - 4. Provide on each side of the belt filter press in NEMA Type 4X enclosures to detect malfunctioning of the tracking system:
 - a. Switches shall close on belt misalignment or over travel and shall shut down the press as specified with the controls.
 - b. The use of electric servos or systems which utilize devices that maintain alignment by a large snap action are not acceptable.
- C. Belt tensioning system:
 - 1. Automatic sensing devices: Continuously monitor the tension of the belt shall be hydraulic actuated.
 - 2. Each belt shall be provided with a belt tensioning system. The belt tensioning system shall be hydraulically actuated. The design of the tensioning system shall be such that the dewatering pressure is directly proportional to belt tension and that adjustments in the tension shall result in immediate changes in dewatering pressure. Manual tensioning systems are not acceptable.
 - 3. Each belt tensioning shall be furnished with an individual control station such that independent adjustment for each belt is possible. The control stations shall incorporate an on/off selector, calibrated pressure regulating valve and a pressure gauge to indicate actual operating pressure on each system.
 - 4. Tension roller: Continuously adjusts to maintain a preset tension under varying dewatering sludge thicknesses.

5. Capable of tensioning the belts to 50 pounds force per linear inch of belt width.
6. Limit switches: Provide manual adjustment to belt tensioning which can operate without stopping the belt press.
7. Design tension rollers such that the dewatering pressure is directly proportional to the belt tension and that adjustments in tension shall result in immediate changes in dewatering pressure.
8. Belt tensioning accomplished through parallel and simultaneous movement of the tension rollers.
9. Tension rollers to have a pressure ram or piston on each end of the roller with mechanisms to ensure parallel and simultaneous movement of the tension rollers.
10. Pressure gauge or similar device shall be provided to indicate belt tension in pounds per linear inch:
 - a. Indicate normal operating range on the gauge.
11. Designed to accommodate a minimum of 2.5 percent increase in belt length.
12. Provide sensor able to detect belt breakage and signal an alarm to the local control panel to shut down the belt press.
13. Each belt shall be provided with a belt tensioning system:
 - a. Manual or electro servo tensioning systems are not acceptable.

2.13 HYDRAULIC SYSTEM

- A. General: Each belt filter press system shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering and tensioning.
- B. Hydraulic system:
 1. Unit shall consist of appropriately sized oil reservoir (316 SS), variable-displacement pressure compensated hydraulic oil pump and drive motor, oil filters, pressure switches and gauges, piping, valves, and other components required for a complete steering and tensioning system for each belt filter press.
 2. The pump, motor, reservoir, oil filter, and valves shall be mounted directly to the belt filter press frame. Alternatively, the hydraulic unit shall be mounted away from the press with a minimum 1/2 inch 316 SS tubing connecting the hydraulic unit to the press. Hydraulic systems schematics and catalog cuts must be included in the equipment bid package.
 3. Pressurized lines shall be 316 SS tubing and shall be rigidly supported on the structural frame of the press.
 4. Hydraulic reservoir shall be made of 316 SS and include a 316L stainless steel drain valve to allow for draining to the hydraulic oil.
 5. Reservoir and legs or base: Type 316 stainless steel.
 6. Provide a variable displacement pressure compensated hydraulic pump with directly connected TEFC electric motor:
 - a. Reservoir capacity shall be 2 gallons or as applicable.
 7. Provide fill, drain, clean out, and level gauge connections in each reservoir.
 8. System to include oil strainer and line valves, pressure reducing valves, pressure gauge, flow control valves, hydraulic oil, and appurtenances.
 9. Hydraulic pump motor:
 - a. Minimum 1 horsepower, maximum speed 1,200 revolutions per minute with motor starter mounted in the local control panel.
 - b. Motor shall not exceed noise level of 70 dBA.

10. Provide air cooled heat exchanger if necessary to prevent hydraulic fluid temperature from exceeding 140 degrees Fahrenheit.
11. Piping and valves: Minimum 1/4 inch size.
12. Provide pressure gauges at each point of application of hydraulic oil to the belt tracking and tensioning system.
13. Hydraulic tubing: Type 316 stainless steel.
14. All hydraulic devices including hydraulic cylinders and micro torque tracking devices connected by hydraulic tubing to a single manifold mounted on each press frame.
15. Provide a high and a low-pressure switch on hydraulic system to actuate an alarm at the press local control panel and shut down the press on high or low hydraulic pressure as specified with the controls.
16. All hydraulic components rated for maximum system operating pressure of 1,000 pounds per square inch.
17. Hydraulic system controls shall be grouped for easy access and ease of operation.
18. There shall be means provided to retract the belt tension cylinders for service.

2.14 EMERGENCY STOP TRIP CORDS

- A. Provide an emergency stop trip cord around each press with a switch mounted in a NEMA Type 4X enclosure. The switch shall be factory pre-wired to the control/signal terminal junction box. The switch shall have two contacts - one shall be connected to the associated BFP local control panel.

2.15 BELT PRESS DRIVE UNIT

- A. Variable speed drive units for each drive will be provided by Division 16 Installing Contractor and not part of the BFP supplier's scope:
 1. Speeds shall be adjustable while the machine is running.
 2. Variable frequency drive will be provided in the MCC line-up by Division 16 Installing Contractor and not part of the BFP supplier's scope. MCC will be located in the new Electrical room.
- B. Electric motor shall be premium efficiency type drive unit meeting the requirements as specified in Section 16405 - Electric Motors:
 1. Manufacturers: The following or equal:
 - a. Eurodrive.
 - b. Baldor.
- C. Variable frequency drives to be provided by Division 16 Installing Contractor will meet the requirements as specified in Section 16485 - Variable Frequency Drives:
 1. Variable frequency drive controls both motors wired in parallel so that rotational timing at the 2 drive rollers is controlled and frequency is matched, unless the Belt Filter Press Manufacturer is controlling drive rollers differently.
- D. Drive unit:
 1. Helical bevel right angle gearshaft mounted gear reducer totally enclosed with all gears running in oil and all drive chains and sprockets completely enclosed in a housing.
 2. AC motor mounting to be C face or as per layout drawings.

- E. Safety guards: Type 316 stainless steel meeting the requirements as specified in Section 15050 - Common Work Results for Mechanical Equipment.
- F. Drive data:
 - 1. Quantity per machine: 2.
 - 2. Variable speed driven:
 - a. Output speed: 0 to 7.50 revolutions per minute.
 - b. Belt speed: 0 to 19 feet per minute minimum.
 - c. AGMA HO Rating (input): 4.64.
 - d. Service factor: Minimum 1.5.
 - e. Service rating: AGMA Class II.
 - 3. Motor data:
 - a. Quantity per machine: 2 (Ashbrook) 2 (Andritz).
 - 4. Horsepower: Minimum 3 horsepower.
 - 5. Power requirements: 460 volts, 3 phase, 60 hertz.
 - 6. Maximum speed: 1,800 revolutions per minute.
 - 7. NEMA design: B.
 - 8. Ambient temperature: 40 degrees Celsius.
 - 9. Insulation class: F.
 - 10. Full load amps: 4.45
 - 11. Service factor: 1.15.
 - 12. Rated for continuous duty.
 - 13. Enclosure: TEFC, mill and chemical severe duty.

2.16 BELT FILTER PRESS LOCAL CONTROL PANEL

- A. Enclosures:
 - 1. NEMA Type 4X, Type 316 stainless steel panel.
 - 2. Panel suitable for mounting free standing as shown on drawings.
 - 3. Panels shall be free-standing vertical panels as specified in Section 17000 - Control Systems: Panels, Enclosures, and Panel Components modified to meet the above specification.
 - 4. Panel shall be U.L. listed and shall be assembled in a U.L. listed facility. Panel shall have a UL label affix to the panel.
 - 5. Provide a minimum of one LED light strip inside each panel that shall turn on when the door is opened. Provide and limit switch to active the interior light.
 - 6. Panels shall come with enough room to allow for construction of all planned mechanical equipment as shown in the Drawings without the need to construct or enlarge any future panel space (with the exception of the local control panels).
- B. Each belt filter press local control panel shall be prewired and tested with terminal strips for external wiring connections and shall have the following:
 - 1. 120 VAC, 60 hertz, 1 phase power input.
 - 2. Main disconnect circuit breaker.
 - 3. Each belt filter press local control panel shall have a PLC/CPU with I/O (input/output) system and PLC system shall meet the requirements as specified in Section 17000 - Control Systems: There are no "or equal" substitutions allowed:
 - a. Allen-Bradley Compactlogix PLC (5370-L33ER) family CPU with I/O system including power supply, CPU module, discrete input, discrete output, analog input, analog output modules, etc.

- b. Furnish and install fiber optic patch panel, Ethernet switch, Panelview touchscreen HMI, power supply, surge suppressors, terminal blocks, wireways, wirings, etc. as needed for a complete and functional belt filter press local control panels.
 - c. Furnish and install UPS (minimum size of 550VA) with bypass switch in each BFP local control panel.
 - 4. Alarm horn and strobe alarm light: LED alarm light on top of the local control panel to illuminate on any alarm condition with silence/reset buttons.
 - 5. LED Lights, pushbuttons, and switches as specified in this Section.
 - 6. Allen-Bradley Panelview Plus 7 graphic terminal color, minimum 10.4 inch shall be provided on each belt filter press local control panel. Refer to Section 17000 for additional requirements. Panelview shall be mounted to the front of the belt filter press local control panel and operator shall be able to operate without needing to open the panel.
 - 7. Refer to Section 17000 for wiring, wiring marking, terminal blocks, fuse, surge protection device (SPD), surge arrestors, and other accessories requirements.
- C. Each belt filter press control system shall be in accordance with requirements specified:
 - 1. The local control panel design will allow local manual operation or remote automatic operation of the BFPs. Furnish all necessary selector switches, E-stop mushroom type button, LED indication lights, push buttons, etc. for manual operation of the BFP and as listed in this specification and as shown on Instrumentation drawings (N-series drawings).
 - 2. The local control panel shall accept hard-wired I/O points as shown on Instrumentation drawings (N-series drawings). If additional I/O points are needed by BFP system such as pull cord trip signal, E-stop signal, etc. shall be included in the local control panel I/O system.
- D. Each belt filter press local control panel shall have the following control and LED indication lights located on the front of the control panel:
 - 1. MANUAL/OFF/AUTO selector switch.
 - 2. Control power ON/OFF switch and LED indicator light.
 - 3. Emergency stop pushbutton (Red mushroom type).
 - 4. Belt press system alarm horn and strobe indication light.
 - 5. Alarm silence pushbutton.
- E. Located on the front of the control panel shall be a control power ON/OFF switch:
 - 1. When in the ON position, the control power ON pilot light will be illuminated and control power shall be distributed to the control system.
 - 2. When in the OFF position, the control system shall be held de-energized.
 - 3. Also located on the control panel shall be an emergency stop pushbutton.
 - 4. It shall be an illuminated mushroom head style pushbutton that when depressed shall immediately de-energize all moving equipment in the system.
 - 5. An alarm horn shall be included for audible alarm annunciation.
- F. Panelview Touchscreen HMI located on the front of each belt filter press local control panel shall have a minimum of the following:
 - 1. Auto Start pushbutton (Only visible in Auto Selection mode).
 - 2. Auto Stop pushbutton (Only visible in Auto Selection mode).
 - 3. Washdown cycle on indicator.
 - 4. Washwater valve OPEN pushbutton and OPEN indicator.

5. Washwater valve CLOSE pushbutton and CLOSED indicator.
6. Low washwater pressure alarm.
7. Hydraulic pump START pushbutton.
8. Hydraulic pump STOP pushbutton.
9. Hydraulic pump RUNNING indicator (or air compressor RUNNING).
10. Hydraulic HIGH PRESSURE FAULT alarm indicator.
11. Hydraulic LOW PRESSURE FAULT alarm indicator.
12. Belt drive START pushbutton with belt drive RUNNING indicator.
13. Belt drive STOP pushbutton.
14. Belt drive FAIL indicator.
15. Belt speed potentiometer.
16. Belt speed indicator in feet/minute.
17. Sludge feed pump AUTO indicator.
18. Sludge feed pump RUNNING indicator.
19. Sludge feed pump FAIL alarm indicator.
20. Sludge pump speed potentiometer.
21. Sludge flow rate indicator (gallons per minute).
22. Belt misaligned alarm indicator.
23. Belt broken alarm indicator.
24. High sludge alarm indicator.
25. Emergency stop alarm indicator.
26. Sludge feed pump START and STOP push buttons.
27. Timer Shut-Off Mode ON/OFF indicator.
28. 24-hour timer in 15-minute increments.
29. Horizontal Conveyor system ON.
30. Inclined Conveyor system ON.
31. Conveyance system fail alarm indicating.
32. And additional indicators and push buttons, if required by belt filter press manufacturer.

G. BFP Control Description:

1. The control system for the presses will allow unattended operation, and must provide automated shutdown and system clean-up in AUTO mode.

H. Operation - Belt Filter Press No. 1, and No. 2:

1. Each belt filter press local control panel (LCP) shall have a MANUAL/OFF/AUTO switch and HMI Panelview touchscreen.
2. In the MANUAL mode, the BFP and all associated equipment necessary to operate the press will be manually started and controlled from the LCP thru HMI Panelview touchscreen.
3. In AUTO mode, operator presses the AUTO START pushbutton at the LCP thru HMI Panelview touchscreen or the press receives the START signal from the PLC. The automatic start sequence involves a series of adjustable time delayed steps as described below. The adjustable time delays are set by the operator at the PLC.
4. In AUTO, the start sequence is as follows:
 - 1) Washwater motorized valve opens.
 - 2) Hydraulic unit starts and the belts are automatically tensioned.
 - 3) After a preset time delay for belt tensioning, the belt drives start and the horizontal and incline conveyor system starts.
 - 4) The press operates for an adjustable time (initial setting 5 minutes) to pre-wet the belts.

- 5) After the belts are pre-wetted, a signal shall be sent to start the sludge feed pump and polymer solution pump. The sludge feed pump and polymer solution pump shall start simultaneously. Note that the polymer feed pump and belt filter press feed pump are interlocked only when both units are in AUTO mode.
 - 6) In Auto mode, the sludge feed rate, and belt speed shall be automatically controlled by the PLC to the adjustable preset setpoints. Refer to specification 11246 (Polymer Blending and Feed Equipment - Liquid) for new Polymer system information. New polymer feed pump shall be automatically controlled by the PLC.
 - 7) Sludge and polymer feed rate and polymer usage shall be monitored by the PLC, if applicable. Sludge and polymer feed flow shall be indicated on the LCP Panelview HMI touchscreen.
 - 8) An emergency trip cord mounted on the press shall stop the press at any time. An emergency stop pushbutton on the LCP and graphical emergency stop pushbutton at the Panelview HMI touchscreen shall also stop the press and all associated equipment and pumps at any time. An emergency stop alarm light shall be indicated on the LCP. The emergency stop shall be interlocked to shut down all belt filter press system equipment whether in MANUAL or AUTO mode.
 - 9) The above sequence shall be programmed such that in each case, for a particular equipment (or motor) to start, the preceding equipment (or motor) in the sequence must be running. Otherwise, an alarm shall be annunciated and the sequence shall not resume until all alarms have been cleared.
5. Under AUTO, the stop sequence is as follows:
 - a. Initiated by pressing the AUTO STOP pushbutton or by receiving a STOP signal from the PLC.
 - b. The sludge feed pump shall stop. The polymer pump shall also stop.
 - c. Horizontal and Inclined conveyors will stop after a preset time delay.
 - d. The press shall enter washdown mode and the WASHDOWN ON indicator will be active on Panelview HMI screen.
 - e. After a preset time delay, the belt drives and hydraulic unit shall stop and the washwater motorized valve shall close:
 - 1) The time delay shall be adjustable.
 6. The belt press may be started in manual mode by placing the MANUAL/OFF/AUTO selector switch in MANUAL. In MANUAL mode, the start sequence is as follows:
 - a. MANUAL mode indicator is illuminated in HMI screen.
 - b. Operator presses the washwater valve OPEN pushbutton thru HMI screen.
 - c. Operator presses the hydraulic pump START pushbutton thru HMI screen.
 - d. After the belts are fully tensioned, the operator presses the belt drive START pushbutton thru HMI screen.
 - e. After a pre-wet time delay, the PRESS READY indicator light in HMI screen will be illuminated.
 - f. The sludge feed pump may be controlled at the LCP via HMI screen, if the pump HAND/OFF/REMOTE switches at each sludge feed pump VFD are in the REMOTE position. The polymer feed pump may be controlled at the LCP via HMI screen, if the polymer dilution system HAND/OFF/REMOTE switches at each polymer dilution system are selected in the REMOTE

position. The sludge feed pump shall be controlled at the LCP with start/ stop pushbuttons and speed adjustment thru HMI screen. When the sludge feed pumps are operated in HAND mode, the pumps must be started from their respective VFD panels with speed adjusted locally at the MCC.

7. The belt press systems and associated pumps are stopped manually by pressing the respective STOP push buttons in the reverse order to that stated above.
 8. When any of the following fault conditions occur, whether the belt press is in AUTO or MANUAL mode, the appropriate fault indicator will be illuminated in HMI screen, and the belt press and all associated equipment will be shut down:
 - a. Emergency stop.
 - b. Low washwater pressure.
 - c. Hydraulic low-pressure fault.
 - d. Belt misaligned.
 - e. Belt broken.
 - f. Belt drive fail.
 - g. Conveyor failure.
 9. The following fault conditions will cause the AUTO STOP sequence to be initiated in the automatic mode. In MANUAL mode, the fault conditions will immediately stop the belt press and all associated equipment. Associated equipment includes all devices started in MANUAL mode as specified in this Section:
 - a. No cake.
 - b. Sludge feed pump fail.
 - c. Loss of sludge flow.
- I. Polymer Feed Control:
1. As part of on-going CMAR project, there will be two TSS analyzers installed and connected to the existing PLC in the Electrical Room No.2. The BFP master PLC program shall message with other Plant PLC to get the TSS values and will let the operator to select the desired meter to use for control. PLC program shall use sludge feed flowmeter for each belt filter press and the calculated TSS values to determine the appropriate Polymer feed rate for each skid mounted polymer dilution system.
- J. Miscellaneous Plant Signals:
1. Each BFP local control panel PLC system shall communicate with other plant PLC system to exchange some data such as signals/controls related to the BFP feed pumps, washwater pumps, existing TSS meters, etc.

2.17 TERMINAL JUNCTION BOXES

- A. Each belt filter press shall be supplied with power terminal junction box and separate control/signal terminal junction box mounted on the belt filter press unit. Each terminal junction box shall be NEMA 4X 316 stainless steel and size as per NEC requirements. Factory installed wiring and raceways between each termination junction box and associated motor and belt filter press devices that are part of belt filter press assembly shall be provided with each belt filter press. Field wiring from belt filter press control panel, MCC, and other field devices shall be interfaced at the terminal junction.

- B. Electrical system components as specified in Division 16, including wiring, raceway, etc.

2.18 BELT FILTER PRESS SYSTEM PLC PROGRAMMING AND COORDINATION MEETINGS

- A. The PLC programming for local belt filter press control panel and associated HMI touchscreen panel shall be fully programmed by the BFP supplier. BFP local control panel PLC system shall communicate with other plant PLC system to exchange other necessary information as describes in other section of this specification. BFP control panel supplier shall provide HMI screens to the installing Instrumentation Contractor to include in the BFP Master Control Panel and stand-alone HMI panel. Installing Instrumentation Contractor shall create other HMI screens such as sludge feed pump system, other miscellaneous instruments, etc. that are not covered in the belt filter press manufacturer's scope. BFP supplier shall copy the HMI screens from the Installing Instrumentation Contractor and load them into the BFP local control panel HMI touchscreen panel and adjust the HMI database as needed.
- B. Belt filter press manufacturer shall include a minimum of three coordination meetings with the installing Instrumentation Contractor to coordinate the PLC programming. The above coordination meetings shall be held at the construction site, unless otherwise agree by Owner/Engineer. Additionally, BFP manufacturer shall include 24 hours of phone calls and 24 hours of face-to-face meetings, a total of 48 hours.

2.19 BELT FILTER PRESS SYSETM HMI PROGRAMMING

- A. Belt filter press manufacturer shall be responsible for HMI programming of the Panelview touchscreen HMI at each belt filter press local control panel.

2.20 SOURCE QUALITY CONTROL

- A. Un-witnessed Factory Testing (non-witness test):
 - 1. The complete BFP control system shall be an un-witnessed factory test, as much as possible before the witness test. Provide a written un-witnessed Factory Test Report for review and approval from Owner/Engineer prior to the witness test.
- B. Factory Acceptance Testing (Witness test):
 - 1. BFP supplier shall test the entire control system at the BFP's supplier factory. The BFP's software programmer shall simulate all inputs and outputs as applicable to the BFP system supplied. The BFP's software programmer shall load the application program into the PLC and HMI system. BFP supplier shall provide a daily schedule for FAT and at the end of each day to have a meeting to review the day's test results.
 - 2. BFP supplier and BFP's software programmer shall check each loop, including I/O mapping, scaling, setpoints, alarms, displays, and HMI screens. Correct deficiencies found and complete correction of deficiencies prior to shipment to site.

3. BFP supplier and BFP's software programmer shall test the applicable control strategy listed in this specification and other specifications. Failed tests shall be repeated and witnessed by the Owner/Engineer.
 4. BFP supplier shall include in his bid for travel expenses for 2 persons (Engineers) and 2 Owner personnel, a total of 4 persons for the entire system WFT duration. WFT duration shall be a maximum of 2 days. Travel expense shall include airfare (one round trip per person), accommodation and food, and car rental for each person during WFT period.
- C. Instrumentation and Controls Meeting:
1. In addition to the field services required per the sections, the BFP MANUFACTURER shall provide a qualified instrument and controls engineer to coordinate with the installing Contractor's Instrumentation System Supplier (ISS) during construction for the following meeting:
 - a. Pre-Construction Meeting:
 - 1) Meeting to coordinate all controls required from and to BFP vendor control panels to Plant SCADA. BFP MANUFACTURER shall share HMI screens with ISS for duplication at Plant SCADA for monitoring.
 - b. Pre-Start-up Meeting:
 - 1) Meeting to coordinate all loop check and functional readiness test, and start-up procedures before start-up of the BFP system. BFP MANUFACTURER shall coordinate with ISS for loading the BFP control function into the master BFP PLC panel and perform functional readiness test. ISS will perform loop check for all instrument and panels to be provided by BFP as well as provided by ISS.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Connect electrical power, water piping, polymer solution piping, and sludge piping.
- C. BFPs shall not, under any conditions be allowed to sit out-of-doors unprotected. At a minimum BFP units shall be covered with a waterproof material in the event of any precipitation and also at all times that construction does not require exposure of the equipment. Covering shall be securely anchored.

3.02 ADJUSTING

- A. Within 30 days after equipment is installed, prior to start-up testing and training, allow a minimum of 8 hours for factory-trained technician to adjust equipment.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Provide training as specified in Sections 01756 and 01010; require factory trained technician to train Owner in proper operation and maintenance of equipment:
 1. Allow minimum 4 training sessions of maximum 4 hours each following a course outline acceptable to the Design Engineer.

2. Training sessions shall occur on 4 consecutive days at times acceptable to the Owner.
 3. Training to include both classroom and field training. As a minimum, cover the following subjects:
 - a. Start-up procedures.
 - b. Shutdown procedures.
 - c. Troubleshooting.
 - d. Selection of polymer types and dosages.
 - e. Replacement of dewatering belts.
 - f. Operating adjustments for performance optimization.
 - g. Preventive maintenance.
 - h. Maintenance procedures.
 - i. Emergency procedures.
 - j. Records keeping.
- B. Provide training within 30 days after completion of initial start-up and before handing over the operations to the Owner:
1. Start training when sufficient experience with sludge character has been obtained.
- C. Produce and deliver electronic format of training to Owner upon completion of training.
- D. The BFP MANUFACTURER shall also provide three hard copies of the Engineer-approved Operations and Maintenance (O&M) Manuals 30 days prior to the training sessions.

3.04 PERFORMANCE TESTING

- A. Provide manufacturer's services for conducting field performance test to demonstrate equipment can meet specified performance requirements as specified in 01756 and below.
- B. Each belt filter press will be tested one at a time. The test period shall consist of one 6-hour steady state test runs on 3 consecutive days with sludge feed, sludge cake, and effluent (combined filtrate and washwater) samples taken at the start of each run and every hour thereafter resulting in a total of 7 samples of each type per day and 21 samples for the 3 day test per belt filter press. At a minimum, the testing shall be done at the design feed rate (both hydraulic and solids loading) during the test. If sufficient WAS is available, the testing shall be done at the maximum feed rate (both hydraulic and solids) to the extent possible. Coordinate with the Owner and installing Contractor to determine the test loading rates before the test and submit a field performance test protocol in coordination with the BFP manufacturer, to the Owner and Engineer for approval. The BFP manufacturer shall hire and pay for the services of a certified laboratory for all lab analysis:
1. The sludge feed, dewatered cake, and effluent samples shall be analyzed for total suspended solids content. The sludge feed shall also be tested for percent VSS and percent ash content.
 2. The resulting solids contents shall be averaged and the average value of each type shall be used to judge satisfactory performance.

3. Polymer solution strength and flow rate shall be recorded and dose in active pounds per dry ton. Maximum polymer usage shall be less than or equal to 30 active lb/DT.
 4. Sludge feed rate shall also be recorded.
- C. The BFP MANUFACTURER's representative shall operate the equipment during the test:
1. The Owner shall furnish personnel to assist in the operation and to take samples.
 2. The Owner working with the installing Contractor shall also furnish sludge, water, utilities, sludge cake disposal, and routine test equipment.
- D. The BFP MANUFACTURER in consultation with the Owner and the Owner's current polymer supplier shall recommend the most suitable and cost effective polymer. BFP MANUFACTURER shall perform necessary polymer testing to determine the most appropriate polymer. If necessary, the BFP MANUFACTURER may choose to perform prior testing with different polymer types to determine the type of polymer and optimum dose for meeting the performance requirements. For any such testing, BFP MANUFACTURER shall coordinate with the installing Contractor and Owner and provide a detailed polymer test plan and also supply the polymer for this test. The BFP MANUFACTURER shall also provide field service staff to collect samples and also hire an outside laboratory for all analysis. Submit the test plan and results to the Owner and ENGINEER for review and approval. BFP MANUFACTURER shall coordinate with the installing Contractor for any instrumentation for measuring sludge feed or polymer feed rates.
- E. The equipment shall have passed the performance test if the specified cake solids, solids capture, and polymer use requirements are met with the press operating under design and maximum hydraulic and solids loading rates.
- F. Should the installed equipment fail to meet the specified performance requirements, the Contractor shall within 30 days make changes in the equipment or method of operation as necessary and the equipment shall be retested at no cost to the Owner. If after a second 30-day period, the equipment still does not meet the performance criteria, the equipment shall have failed the performance test and the Owner shall require its removal and replacement with the specified equipment at no additional cost to the Owner.

END OF SECTION

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SECTION 13446

MANUAL ACTUATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Valve and gate actuators.
 - 2. Handwheel actuators.
 - 3. Key operated valves.
 - 4. Bench stands.
 - 5. Floor stands.
 - 6. Accessory equipment and floor boxes.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 09960 - High-Performance Coatings.
 - b. Section 15050 - Common Work Results for Mechanical Equipment.

1.02 REFERENCES

- A. Aluminum Association (AA):
 - 1. DAF-45 - Designation System for Aluminum Finishes.

- B. American Water Works Association (AWWA).

1.03 SUBMITTALS

- A. Shop drawings: Include shop drawings for hydraulic gate lifts with shop drawings for gates as integrated units.

1.04 QUALITY ASSURANCE

- A. Provide valve actuators integral with valve or gate, except for valve actuators utilizing T-wrenches or keys, and portable actuators intended to operate more than 1 valve.

- B. Provide similar actuators by 1 manufacturer.

- C. Provide gates and hand operating lifts by 1 manufacturer.

- D. Provide hydraulic gate lifts by 1 manufacturer.
- E. Provide hydraulic valve actuators and motorized actuators by 1 manufacturer.

1.05 WARRANTY

- A. As specified in Section 15050.

1.06 MAINTENANCE

- A. Extra materials:
 - 1. Key operated valve keys or wrenches: Furnish a minimum 4 keys with 4-foot shafts and 3-foot pipe handles or wrenches with 4-foot shafts and 3-foot handles for operating key operated valves.

PART 2 PRODUCTS

2.01 VALVE AND GATE ACTUATORS

- A. Stem covers:
 - 1. Aluminum pipe; threaded cap on top; bolted aluminum flange on bottom; 1- by 12-inch slots cut at 18 inches on center in front and back of pipe; capable of covering threaded portion of greased stems that project above actuators when gates or valves are opened or closed.
- B. Stem cover flanges, pipes and caps:
 - 1. After fabrication, etch and anodize to produce the following chemical finishes in accordance with AA publication DAF-45:
 - a. A 41 - Clear Anodic Coating.
 - b. C 22 - Medium Matte Finish.
- C. Gate stem covers: Concentric with stem.
- D. Position indicators:
 - 1. Tail rods on hydraulic cylinders, or dial indicators with clear full-open and closed position indicators, calibrated in number of turns or percentage of opening.
- E. Manual or power actuator size:
 - 1. Sized to deliver maximum force required under most severe specified operating condition, including static and dynamic forces, seat and wedge friction, and seating and unseating forces with safety factor of 5, unless otherwise specified.
- F. Actuator size: Capable of supporting weight of suspended shafting unless carried by bottom thrust bearings; shaft guides with wall mounting brackets.
- G. Provisions for alternate operation: Where specified or indicated on the Drawings, position and equip crank or handwheel operated geared valve actuators or lifts for alternate operation with tripod mounted portable gate actuators.
- H. Operation: Counterclockwise to open with suitable and adequate stops, capable of resisting at least twice normal operating force to prevent overrun of valve or gate in open or closed position.

- I. Open direction indicator: Cast arrow and legend indicating direction to rotate actuator on handwheel, chain wheel rim, crank, or other prominent place.
- J. Buried actuator housing: Oil and watertight, specifically designed for buried service, factory packed with suitable grease, completely enclosed space between actuator housing and valve body so that no moving parts are exposed to soil; provide actuators with 2-inch square AWWA operating nut.
- K. Worm gear actuators: Provide gearing on worm gear actuators that is self-locking with gear ratio such that torque in excess of 160 foot-pounds will not need to be applied to operate valve at most adverse conditions for which valve is designed.
- L. Traveling nut actuators: Capable of requiring maximum 100 foot-pounds of torque when operating valve under most adverse condition; limit stops on input shaft of manual actuators for fully open and closed positions; non-moving vertical axis of operating nut when opening or closing valve.

2.02 HANDWHEEL ACTUATORS

- A. Manufacturers: One of the following or approved equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman Industries, Incorporated.
- B. Coating: Handwheel as specified in Section 09960.
- C. Mounting: Floor stand or bench stand. Unless otherwise indicated on the Drawings position actuator 36 inches (nominal) above top of walkway surface.
- D. Bearings above and below finished threaded bronze operating nut: Ball or roller.
- E. Wheel diameter: Minimum 24 inches.
- F. Indicator: Counterclockwise opening with arrow, and word OPEN cast on top of handwheel indicating direction for opening.
- G. Pull to operate: Maximum 40 pounds pull at most adverse design condition.
- H. Stem travel limiting device: Setscrew locked stop nuts above and below lift nut.
- I. Grease fittings: Suitable for lubrication of bearings.

2.03 HAND-CRANKED GEARED ACTUATORS

- A. Type: Single removable crank; fully enclosed.
- B. Mounting: Floor and bench stand. Unless otherwise indicated on the Drawings position actuator 36 inches (nominal) above top of walkway surface.
- C. Operating nut: When scheduled for portable actuators.
- D. Geared lifts: 2-speed with minimum ratio of 4 to 1.
- E. Teeth on gears, spur pinions, bevel gears, and bevel pinions: Cut.
- F. Lift nuts: Cast manganese bronze.

- G. Exterior surfaces on cast-iron lift parts: Smooth.
- H. Bearings above and below flange on lift nuts: Ball or roller; capable of taking thrust developed by opening and closing of gates under maximum operating head; with bronze sleeve bearings and sufficient grease fittings for lubrication of moving parts, including bearings and gears.
- I. Crank rotation indicator: Cast arrow with word OPEN in prominent location readily visible indicating correct rotation of crank to open gate.
- J. Hand cranks: 15-inch radius; requiring maximum 25 pounds pull to operate gate at maximum operating head; with:
 - 1. Revolving brass sleeves.
 - 2. Gears, spur pinions, bevel gears, and bevel pinions with cut teeth.
 - 3. Cast manganese bronze lift nuts.
 - 4. Cast-iron lift parts with smooth exterior surfaces.
- K. Indicator: Dial position type mounted on gear actuator; enclosed in cast-iron or aluminum housing with clear plastic cover; marked with fully open, 3/4, 1/2, 1/4, and closed positions.

2.04 FLOOR BOXES

- A. Manufacturers: One of the following or equal:
 - 1. Waterman industries, Inc.
- B. Floor boxes: Cast-iron; with:
 - 1. Counter type indicator.
 - 2. Hinged, lockable lid with directional arrow.
 - 3. 2-inch square AWWA operating nut.
 - 4. Packing gland providing drip-tight seal around valve shaft.

2.05 FLOOR STAND

- A. Manufacturers: One of the following or equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman industries, Inc.
- B. Floor stand assemblies: Heavy-duty cast-iron, suitable for mounting specified actuator.

2.06 BENCH STANDS

- A. Manufacturers: One of the following or equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman industries, Inc.
- B. Bench stands: Handwheel actuators or hand crank, geared actuators conforming to hand-cranked geared actuator requirements, except capacity to be mounted on haunch, wall bracket, or self-contained gate yoke.

2.07 ACCESSORY EQUIPMENT

- A. Wall brackets or haunches: As indicated on the Drawings.
- B. Stems: Stainless steel; sized to match output of actuator; minimum gate or valve operating stem diameter; maximum 200 slenderness ratio.
- C. Stem couplings: Stainless steel; internally threaded to match stem; lockable to stem by set screw.
- D. Stem guides: Cast-iron with silicon bronze bushing; maximum 200 slenderness ratio; capable of being mounted with wall bracket; adjustable in 2 directions.
- E. Wall brackets: Cast-iron, capable of withstanding output of actuator, adjustable in 2 directions.
- F. Stem stuffing boxes: Cast-iron, with adjustable gland and packing.
- G. Fasteners and anchor bolts: Type 316 stainless steel.
- H. Geared valve actuators: Provided with cut gears, either spur or worm; sized to operate valves at most adverse design condition; with maximum 40-pound pull at handwheel or chain wheel rim.
- I. Geared valve traveling nut actuators: Acceptable only where specified or indicated on the Drawings.
- J. Accessory equipment for valves and gates requiring remote actuators: Operating stems, stem couplings, stem guides, wall brackets, and stem stuffing boxes.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install floor boxes in concrete floor with lid flush with floor.
- B. After installation of gate and stem covers, mark stem covers at point where top of stems are at full-open position and at closed position.
- C. Attach floor stand to structure with anchor bolts.
- D. Install stem stuffing boxes where operating stems pass through intermediate concrete floor slabs.

3.02 SCHEDULES

- A. Geared actuators: Provide geared actuators for following valves:
 - 1. Butterfly valves larger than 6 inches, nominal size, on liquid service.
 - 2. Butterfly valves larger than 10 inches, nominal size, on gas and air service.
 - 3. Plug valves 6 inches, nominal size, and larger.

- B. Handwheel actuators: Provide handwheel actuators for valves mounted 6 feet or less above floors.
- C. Chain wheel actuators: Provide chain wheel actuators for valves mounted more than 6 feet to centerline above floors.

END OF SECTION

SECTION 13448

INTELLIGENT ACTUATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Electric motor-driven actuators for valves.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 14555 - Shaftless Screw Conveyor.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. C504 - AWWA Standard for Rubber-Seated Butterfly Valves.
 - 2. C540 - AWWA Standard for Power-Actuating Devices for Valves and Slide Gates.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. 250 - Enclosures for Electrical Equipment (1000 V Maximum).

1.03 DEFINITIONS:

- A. NEMA:
 - 1. Type 4X enclosure in accordance with NEMA 250, Type 4/6.

1.04 SUBMITTALS

- A. Product data:
 - 1. Electrical ratings:
 - a. Voltage and number of phases.
 - b. Starting and running current.
 - c. Voltage levels and source for control and status.
 - 2. Description of integral control interface.
 - 3. Environmental ratings, including NEMA enclosure rating and submergence capabilities.
 - 4. Gear ratios for both manual and motorized actuation.
 - 5. Opening and closing directions.
 - 6. Allowable starts per hour.
 - 7. List of all included options and accessories.

8. Full travel times.
 9. Gearbox data including gear ratio, and gearbox efficiency.
 10. Affidavit in accordance with AWWA C540.
- B. Shop drawings:
1. Wiring diagrams:
 - a. Include all options and expansion cards furnished with each actuator.
 2. Dimensioned drawings of each valve and actuator combination.
 3. Dimensioned drawings of each valve gearbox.
 4. Electric motor data.
- C. Calculations: Submit the following for each valve/gate size and class:
1. Operating torque calculations.
 2. Maximum torque calculations for seating and unseating.
 3. Maximum operating torque at starting and normal operation.
- D. Test reports:
1. Factory test report and certificate.
- E. Manufacturer's instructions:
1. Include manufacturer's instructions, description of system operation, start-up data, and troubleshooting checklists.
- F. Operations and maintenance data:
1. Include manufacturer's literature; cleaning procedures, replacement part lists, wiring diagrams, and repair data.
 2. Include a list of all configurable parameters, and the final values for each.
 3. List of recommended spare parts.
 4. List of special tools necessary for proper operation and/or maintenance.
 5. Exploded view drawings that illustrate all assemblies, sub-assemblies, and components.
 6. Routine test procedures for all electronic and electrical circuits.
 7. Troubleshooting chart covering the complete valve and controls/electrical power systems, showing description of trouble, probable cause, and suggested remedy.
 8. Certified factory and field-test results.

1.05 QUALITY ASSURANCE

- A. Obtain required information from the valve/gate supplier, including but not limited to:
1. Interface to gate or valve.
 2. Operating range:
 - a. Quarter turn or multi-turn.
 - b. Required turns for full travel on multi-turn applications.
 3. Direction of rotation for opening and closing.
 4. Maximum and normal torque requirements.
- B. All motorized, intelligent actuators shall be the product of a single manufacturer for all valve and gate applications on this project, regardless of gate or valve type, manufacturer, or supplier.

1.06 SPARE PARTS

- A. Provide the following spare parts (minimum 10 percent of total number of actuators of each model type furnished, but not less than 1 for each model of actuator furnished):
 - 1. Stem nut.
 - 2. Worm shaft subassembly.
 - 3. Drive sleeve subassembly.
 - 4. Complete actuator seal kit.
 - 5. Actuator gearbox oil (sufficient quantity to fill 4 gearboxes).
 - 6. Encoder.
 - 7. Control module.
- B. Provide 1 spare motor for each size motor furnished.
- C. All spare parts should be labeled on the outside of the container what equipment the part belongs.

1.07 WARRANTY

- A. Each actuator shall be warranted for a minimum of 24 months of operation up to a maximum of 36 months from shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Equipment will one of the following only. No exceptions will be acceptable:
 - 1. Limatorque.

2.02 CHARACTERISTICS

- A. Provide actuators complete and operable with all components and accessories required for operation. In order to maintain the integrity of the enclosure, setting of the torque levels, position limits, and configuration of the indication contacts etc. shall be carried out without the removal of any actuator covers. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools must be capable of restricting access for secure authorized release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.
- B. Power supply:
 - 1. Voltage and phases as indicated in the Schedule.
 - 2. Valve or gate motion independent of power supply phase rotation.
An external 24VDC backup power source must be provided to maintain settings and track valve position when main power is off. In the event of a (main) power (supply) loss or failure, the position contacts must continue to be able to supply remote position feedback and maintain interlock capabilities.

- C. Size actuator to move gates or valves from full open to closed position within the time indicated in the Schedule:
 - 1. If an operating time is not indicated on the Schedule, size the actuator to move gates or valves at minimum 12 inches per minute under maximum load. Measure rate of closure for valves at maximum diameter of disc, plug, or ball.
 - 2. Size actuators so that gear boxes are not required where possible.

- D. Control interface:
 - 1. Configuration:
 - a. Input devices from the actuator for output settings, control values, ranges, torque switch settings, valve positions switch settings, and options.
 - 2. Local interface, integral to actuator:
 - a. Non-intrusive, non-contacting Hall effect sensor selector switches:
 - 1) LOCAL-OFF-REMOTE:
 - a) Motor actuator operation is prevented with the switch in OFF.
 - 2) OPEN-STOP-CLOSE:
 - a) Controls the valve when LOCAL-OFF-REMOTE is in LOCAL.
 - b) Configurable between maintained (actuator runs until end of travel, high torque, or a LOCAL-OFF-REMOTE is switched to OFF) and momentary (actuator stops when lever is released).
 - b. Local display:
 - 1) Valve fully open and fully closed indicators.
 - 2) Numerical display showing actual valve position in percent of travel.
 - 3. Control inputs:
 - a. Capable of using 120 VAC or 24 VDC inputs.
 - b. Controls the valve when LOCAL-OFF-REMOTE is in REMOTE.
 - c. Isolated inputs capable of operating from external control voltage source or internal power supply:
 - 1) Furnish a 120 VAC or 24 VDC control power supply within the actuator.
 - d. Provide the following inputs:
 - 1) OPEN.
 - 2) CLOSE.
 - 3) STOP.
 - e. OPEN and CLOSE inputs configurable between maintained (actuator runs until end of travel, high torque, or a STOP input) and momentary (actuator stops when command is removed).
 - 4. Status outputs:
 - a. Monitor relay output: Dry contact, normally closed, opens when actuator is not in REMOTE or in the event of any internal fault or alarm condition.
 - b. Dry contact outputs configured for the functions indicated on the Drawings. Provide the following outputs for all actuators:
 - 1) Fully closed.
 - 2) Fully open.
 - 3) LOCAL-OFF-REMOTE in REMOTE position.
 - 4) Fault.
 - c. All output contacts rated for 5 amps, 120 VAC and 24 VDC.
 - 5. Analog input:
 - a. Provide a 4-20 milliampere analog input for analog modulating valves when indicated on the Drawings.
 - b. Modulate valve to maintain position based on analog input value.
 - c. Maximum input impedance 250 ohms.

6. Analog output[s]:
 - a. Provide an isolated 4-20 milliampere analog output(s) when indicated on the Drawings:
 - 1) Loop power sourced from the actuator power supply.
 - 2) Capable of driving into a load up to 500 ohms.
 - 3) Output proportional to process value(s) indicated on the Drawings.
 - 4) Valve or gate position.
 - 5) Operating torque.

2.03 FEATURES

- A. Time delay on reversal: Incorporate time delay between stopping actuator and starting in opposite direction to limit excessive current, torque, and heating from instantaneous reversal.
- B. Data logging/Display:
 1. The actuator display shall include a fully configurable dot-matrix display element with a minimum pixel resolution of 168 x 132 to display operational, alarm, configuration, and graphical datalogger information. The text display shall be English.
 2. Datalogger graphical displays should as a minimum be able to display log and trend graphs on the local LCD for the following:
 - a. Torque versus Position.
 - b. Number of Starts versus Position.
 - c. Number of Starts per hour.
 - d. Dwell Time.
 - e. Average Temperature.
 3. The main display shall be capable of indicating 4 different home-screens of the following configuration:
 - a. Position and Status.
 - b. Position and Torque (analog).
 - c. Position and Torque (digital).
 - d. Position and Demand (positioning).
 4. Provision shall be made for the addition of an optional environmental cover to protect the display from high levels of UV radiation or abrasive materials.
 5. The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.
 6. In the event of a (main) power (supply) loss or failure, an external 24VDC power supply shall be required so the position contacts will continue to be able to supply remote position feedback and maintain interlock capabilities.

2.04 MATERIALS

- A. Construct motorized actuators of materials suitable for the environment in which the valve or gate is to be installed.

2.05 COMPONENTS

- A. Motors:
 1. Specifically designed for valve actuator service with high starting torque, totally enclosed non-ventilated construction.

2. Torque ratings equal to or greater than that required for valve seating and dynamic torques with a 25 percent factor of safety:
 - a. Design requirements for rubber-seated AWWA butterfly valves:
 - 1) Design actuators for maximum gate or valve operating torque, in accordance with and using safety factors required in AWWA C504 and AWWA C542:
 - a) Valve actuator torque requirement for open-close service: Not less than the required valve-seating and dynamic torques under design operating conditions in accordance with AWWA C504.
 - b) Valve actuator torque requirement for modulating service: Not less than twice the required valve dynamic torque under design operating conditions in accordance with AWWA C504.
 - b. Design requirements for slide gates, gate valves, knife gate valves, globe valves, and diaphragm valves:
 - 1) Design valves and actuators for maximum operating torque, in accordance with and using safety factors required in AWWA C542.
 - 2) Design for the maximum torque and thrust running load over the full cycle.
 - 3) Maximum torque or thrust rating: The actuator stall torque or maximum thrust output shall not exceed the torque or thrust capability of the valve or gate, as determined by the valve or gate manufacturer.
 3. Capable of being removed and replaced without draining the actuator gear case.
 4. Motor bearings shall be amply proportioned of the anti-friction type and permanently lubricated.
 5. Rated for operating under the following conditions without exceeding temperature limits with ambient temperature of 40 degrees Celsius:
 - a. Continuous operation for 15 minutes or twice the open-to-close operating time (whichever is greater) at normal operating torque or 33 percent of maximum torque (whichever is greater).
 - b. 60 starts per hour for open/close service or 1,200 starts per hour for modulating service.
 6. Provide the following motor protection features:
 - a. Jammed valve (no valve motion detected through a time delay).
 - b. High motor temperature (sensed by an embedded thermostats).
 - c. High torque.
 - d. Single phasing protection.
- B. Enclosures:
1. Actuator housing ratings as indicated in the Schedule.
 2. Stainless steel external fasteners.
 3. Actuators shall be o-ring sealed, watertight to IP66/IP68 26feet for 96hrs, NEMA 4X. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed on site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.
 4. Provide the following minimum enclosure ratings:
 - a. NEMA Type 4X enclosure for all applications.

5. Position Actuators that are not accessible shall have the capability of remote mounting the entire motor control assembly and shall be suitable for remote connection to the electric actuator up to 100 m distance, include local control facilities, a backlit LCD display and terminals for communication highway connection to the host actuator housed within a self-contained, double-sealed enclosure. In order to maintain the integrity of the enclosure, setting of the actuator torque levels, position limits, and configuration of the indication contacts etc. shall be carried out without the removal of any covers via a Bluetooth® wireless interface.
- C. Position sensing:
1. Electronic and adjustable using a solid-state encoder wheel:
 - a. Mechanical limit switches and potentiometers are not acceptable.
 2. Capable of retaining position and monitoring valve or gate motion when valve is manually actuated and when main power is not present.
 3. Valve range and position switch outputs field adjustable.
- D. Torque sensing:
1. Torque shutdown setting: 40 percent to 100 percent rated torque:
 - a. Adjustable in 1 percent increments.
 2. Capable of interrupting control circuit during both opening and closing and when valve torque overload occurs.
 3. Electrical or electronic torque sensing.
 4. Independent of variations in frequency, voltage, or temperature.
 5. Provide a temporary inhibit of the torque sensing system during unseating or during starting in mid-travel against high inertia loads.
 6. Provide visible verification of torque switch status without any housing disassembly.
- E. Manual actuators:
1. Hand wheel for manual operation:
 - a. The handwheel, when declutched, shall operate independently of any motor driven gear sets.
 - b. Maximum 80 pound pull on rim when operating gate or valve under maximum load.
 - c. Provide pull chain when motorized actuator is located more than 6 feet above floor surface (see mechanical drawings for elevations):
 - 1) Chain shall be of sufficient length to reach approximately 4 feet above the operating level.
 - 2) Where the chain obstructs an aisle or walkway, provide holdback or other means to ensure chain does not create a nuisance or hazard to operating personnel.
 2. Declutch lever: Padlockable, capable of mechanically disengaging motor and related gearing and freeing hand wheel for manual operation.
- F. Gearing: Hardened alloy steel spur or helical gears and self-locking, alloy bronze worm gear set:
1. Accurately cut to assure minimum backlash.
- G. Bearings:
1. Anti-friction bearing with caged balls or rollers throughout.
 2. Sealed-for-life type thrust bearings housed in a separate thrust base.

- H. Drive bushing:
 - 1. Easily detachable for machining to suit the valve stem or gearbox input shaft.
 - 2. Positioned in a detachable base of the actuator.
- I. Lubrication:
 - 1. Provide totally enclosed actuator gearing with grease filled gear case suitable for operation at any angle.
 - 2. Actuators requiring special or exotic lubricants are not acceptable.

2.06 ACCESSORIES

- A. Software:
 - 1. Furnish PC-based diagnostic and configuration software to display diagnostic data and configure actuators.
- B. Termination Module Cover:
 - 1. For actuators on a valve network provide a means to keep the valve network in service, in the event where the actuator must be removed.
 - 2. All actuators including the part-turn gearbox (if applicable) shall include a mechanical dial position indicator (MDPI) for the purpose of providing position indication.

2.07 SOURCE QUALITY CONTROL

- A. Factory test:
 - 1. Test each actuator in the factory, and submit an individual test certificate for each actuator.
 - 2. Perform a high potential test and record the following information:
 - a. Test voltage.
 - 3. Simulate a maximum and typical valve loads and record the following information:
 - a. Current and power factor at maximum and set torque values.
 - b. Torque as measured by the actuator.
 - c. Actuator output speed or operating time.
 - 4. Performance testing: Conduct performance test for each actuator simulating valve operating torque from full-open to full-close and from full-close to full-open. The following information shall be recorded during each performance test:
 - a. Torque at maximum torque setting.
 - b. Current at maximum torque setting.
 - c. Test voltage and frequency.
 - d. Actuator output speed and operating time for full-open to full-close.
 - e. Amperage draw on motors at breakaway and under normal operation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install actuators in accordance with manufacturer's instructions.

3.02 ON-SITE START-UP ASSISTANCE

- A. Prior to start up, Contractor shall inform service technicians of all requirements of the certificate of proper installation. All forms and documentation required for the certificate of proper installation shall be given to service technician prior to start up. Minimum of 1 day per two actuators.

3.03 MOTORIZED ACTUATOR SCHEDULE

- A. Provide all actuators required by the Drawings:
 - 1. Major process actuators are listed in the Intelligent Actuator Schedule.
 - 2. The schedule does not include all number and types of actuators required for the Project.

- B. Abbreviations relating to type:
 - 1. BFV = Butterfly Valve.
 - 2. BV = Ball Valve.
 - 3. PV = Plug Valve.
 - 4. SG = Slide Gate.

- C. Abbreviations relating to actuator type:
 - 1. O/C = Open and Close Service.
 - 2. MOD = Modulating Service.

- D. Abbreviations relating to controls:
 - 1. PA = Profibus PA.
 - 2. DP = Profibus DP.
 - 3. DN = DeviceNet.
 - 4. FF = Foundation Fieldbus H1.
 - 5. MB = Modbus RTU (RS-485).
 - 6. NET = Manufacturer's proprietary network.
 - 7. A = Analog (4-20mA) control, modulating duty.
 - 8. D = Discrete control, modulating duty.
 - 9. D-O/C = Discrete Open/Close.

END OF SECTION

INTELLIGENT ACTUATOR SCHEDULE

Item	Quantity	Tag Number	Type	Size	Actuator Type	Rating	Voltage	Notes	Open Time	Controls
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 1	1	L-CON-001-GAT-001	SG		O/C	4	480/3/60	1	60 s	D-O/C
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 2	1	L-CON-001-GAT-002	SG		O/C	4	480/3/60	1	60 s	D-O/C
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 3	1	L-CON-001-GAT-003	SG		O/C	4	480/3/60	1	60 s	D-O/C
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 4	1	L-CON-001-GAT-004	SG		O/C	4	480/3/60	1	60 s	D-O/C
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 5	1	L-CON-001-GAT-005	SG		O/C	4	480/3/60	1	60 s	D-O/C
Westside Regional WRF Truck Loading Station Conveyor Slide Gate No. 6	1	L-CON-001-GAT-006	SG		O/C	4	480/3/60	1	60 s	D-O/C
Notes:										
(1) Field verify characteristics prior to sizing motor actuator.										